Parent Outcomes from a Family-Based Behavioral Nutrition and Physical Activity Program: The Athletes for Life Study

by

Adrian Chavez

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved July 2015 by the
Graduate Supervisory Committee:

Sonia Vega-López, Chair
Noe Crespo
Meg Bruening
Eric Hekler
Gabriel Shaibi

ARIZONA STATE UNIVERSITY

August 2015

ABSTRACT

Background: Latinos have disproportionately high rates of obesity and type 2 diabetes. Family-based interventions may reduce chronic disease risk among Latinos across generations.

Purpose: To assess the efficacy of Athletes for Life (AFL), a 12-week community-and-family-based behavioral intervention, for improving diet, physical activity (PA), anthropometrics, fitness, and biochemical outcomes among mostly Latino parents.

Methods: Parents with at least one child 6-11 years of age were randomized to active AFL participation (n=14) or a wait-list control (n=14) group. AFL consisted of twice weekly 90 minute sessions (45 minutes of nutrition-focused lessons and 45 minutes of PA participation) designed to promote fruit and vegetable consumption, reduction of sugar intake, and increasing habitual PA. Data were collected prior to and immediately after the 12 week intervention.

Results: Participants (37.9±7.2y) were mostly Latino (93%), Spanish speaking (68%), and women (93%). Relative to participants in the control group, AFL participants had a significant reduction in body fat (-1.1±1.2% vs. 0.2±1.2%; p=0.014), resting (-7.6±10.2 bpm vs. +2.1±6.8 bpm; p<0.01), exercise (-8.4±8.7 bpm vs. +0.4±7.3 bpm; p<0.01), and recovery heart rate (-11.9±12.8 bpm vs. -0.3±11.4 bpm; p=0.01), and one mile run time (-1.5±1.0 min vs. -0.1±0.9 min; p<0.01), and a significant increase in estimated VO2 peak (+1.9±1.9 ml/kg/min vs. 0.0±1.8 ml/kg/min; p=0.01). AFL participants also reported an increase in the number of days/week accumulating 30 minutes of MVPA (+0.8±3.2 vs. -1.5±2.3; p=0.004) and daily servings of fruits

(+1.3±1.4 vs. +0.3±1.4; $p<0.05$) and vegetables (+1.8±1.7 vs. +0.1±1.2; $p<0.05$), relative to control participants. There were no significant differences between groups in changes in diet assessed by 3-day food record, accelerometer-measured PA, weight, blood pressure, visceral fat, biomarkers for cardiovascular disease or nutritional biomarkers.

Conclusions: Despite the lack of effects on diet and PA behaviors, AFL shows promising preliminary efficacy for reducing body fat and improving fitness among adult participants. Future research aimed at improving fitness among Latino parents with family-based intervention is warranted.

DEDICATION

This paper is dedicated to my mother, Bonnie Garcia and my son Jace. My mom's unconditional love and constant encouragement have helped me to persevere and continue to follow the goals that I set for myself. She is my biggest fan and she has helped me to feel confident when facing adversity and difficult times. I hope that I am able to do the same for Jace as he grows older and also embarks on his own pursuits. Having my son Jace during my doctoral studies has made completing this dissertation harder than I could have ever imagined. His unlimited energy, which is impossible to keep up with now, will undoubtedly enable him to do great things and I am grateful for the opportunity to be his father.

ACKNOWLEDGMENTS

I would like to express the highest gratitude to my advisor, Dr. Sonia Vega-López, for guiding me through this process and supporting my development as a researcher. She consistently exceeds her responsibilities as a mentor and provides valuable assistance and detailed feedback for her students, which is a reflection of her passion for science. I would also like to give special thanks to Dr. Noe Crespo. Without him I would not have had the opportunity to conduct this research that I have developed a passion for. He placed a great deal of trust in me to be a leader in this program and the experience that I have gained as a result is invaluable. I am appreciative for each of my additional committee members, Dr. Meg Bruening, Dr. Gabriel Shaibi, and Dr. Eric Hekler, for their support, patience, and understanding throughout this process. I am also grateful for my quasi-committee member, Dr. Mike Todd, who did not hesitate to step in as a substitute when needed and who provided me with immense support for conducting my statistical analyses.

I would like to acknowledge the funding sources who made this project possible. The overarching project that the current study was a part of was funded by the American Heart Association (Grant # 14SDG20490382; P.I. Dr. Noe Crespo). The measurement of total anti-oxidants and carotenoids was funded by the Graduate and Professional Student Association at ASU through the Graduate Research Support Program. Formative work was also funded by the Graduate and Professional Student Association as well as departmental start-up funds provided to Dr. Noe Crespo.

I am also grateful for the individual support that I received during my doctoral studies. I was funded by the Doctoral Enrichment Fellowship provided by the Graduate College at ASU during my first year as a doctoral student, and for the past two years, I have been funded by NIH R25 Initiative for Maximizing Student Development (Grant # 5R25GM099650-04; P.I. Dr. Stuart Newfeld). These funding sources have been instrumental in provided me the time to focus specifically on research activities and conducting this project would not have been possible without this support.

This project took a large team and I would like to acknowledge all of the volunteers who gave their time, energy, and passion to help successfully implement this study. I would like to recognize our clinical research staff, Ginger Hook, Cassie Smith, and Amanda Brooks, who helped to draw blood, run DEXA scans, and conduct biochemical analysis. A special acknowledgement goes to Leopoldo Hartmann who is the backbone of the Athletes for Life study. His humility, empathy, and resilience are inspiring. I would also like to acknowledge our community partners, Tony Tarango and Frank Ray for their dedication to the South Phoenix community. Last, I would like to express my sincere gratitude to all of the participants in our study. It was a pleasure working with you all and I am confident that I learned more than I taught, and I am thankful for that.

TABLE OF CONTENTS

APPENDIX Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER 1

INTRODUCTION

For the purpose of this dissertation, the term "Latino" will be used to describe all population sub-groups of Latin-American origin. In Phoenix, Arizona, where this research was conducted, 88% of the Latino population is of Mexican origin (1). Therefore, some of the data presented in the following paragraphs is specific to individuals of Mexican origin rather than the Latino population as a whole.

The United States (US) spends the most money per capita on healthcare and has one of the most technologically advanced healthcare systems, yet ranks poorly on many health metrics including life expectancy at birth (2). The relatively poor health status of Americans is complex and can be attributed to several factors, however, the profound impact of obesity and related cardiovascular and metabolic disorders (e.g. type 2 diabetes, cardiovascular disease) is clear (2). The US has the world's highest obesity rate among adults, 34.9%, the fourth highest rate of overweight and obesity among children, and the highest rate of self-reported overweight among 15 year olds (2, 3). Obesity is associated with increased risk of type 2 diabetes, cardiovascular disease, cancer and neurodegenerative disease, and in 2008 obesity was associated with an additional $1,723 in medical expenditures per person which translates to $98.1 billion for the US as a whole (4). Conservative estimates for continually rising obesity trends predict that between 2010 and 2030 obesity will contribute to 6 million excess cases of diabetes, 5 million excess cases of heart disease and stroke, 400,000 excess cases of cancer, and $66 billion in excess medical expenditures (5). Obesity and obesity related chronic conditions have devastated the health of the American population so much so that children born in the 21st

century in the US are the first generation in modern history to have a shorter life expectancy than their parents (6).

Latinos, the largest and fastest growing minority sub-group in the United States experience disproportionate rates of obesity and type 2 diabetes compared to non-Latino whites (3, 7-10). Most recent estimates indicate that over 40% of Latino adults are obese compared to 33% among non-Latino whites (3). In addition, the prevalence of diabetes among Latino adults is almost 70% higher than among non-Latino whites (11). Among children 22.4% of Latinos have a BMI at or above the 95th percentile, compared to only 14.1% among non-Latino white children (3). These disparities are even greater among younger children. Latinos 2-5 years of age are 4.5 times more likely (16.7% vs. 3.5%) to have a BMI at or above the 95th percentile and Latinos 6-11 years of age are twice as likely (26.1% vs. 13.1%) (3). In addition, Latino children and adolescents are three times as likely to develop type 2 diabetes (12). Given estimates that the Latino population will reach 30% of the total US population by the year 2050 (13) and the disproportionately high rates of obesity and type 2 diabetes among Latinos, particularly among children, it is imperative to develop preventive strategies for reducing obesity and diabetes among this sub-group in order to make strides in closing these gaps and achieving health equity (7, 14).

Physical inactivity, low physical fitness, and a diet low in fruits and vegetables and high in added sugars are associated with an increased risk of obesity, type 2 diabetes, and related co-morbidities (15-22). Data from 2000-2003 indicate that over 50% of the Latino population reported no leisure time physical activity (PA) (23). Accelerometer data demonstrate that Latino men and women age 20-59 averaged only 10.5 and 6.1

minutes per day of moderate and vigorous PA (MVPA), well below national recommendations of 150 minutes per week (24). Following migration to the US, Latinos begin to adopt dietary habits reflective of the standard American diet comprised of a lower consumption of fruits and vegetables, and higher consumption of added sugars, and sugar-sweetened beverages (SSB) compared to their counterparts who have remained in their native country (7). Data from the National Health and Nutrition Examination Survey (NHANES) 2003-2004 indicate that only 6.6% and 10.2% of Latinos are consuming the recommended amounts of fruits and vegetables, respectively (25). Pooled data from NHANES 2003-2004 and the National Health Interview Survey (NHIS) 2005 indicate that Latino men and women are consuming approximately 18 and 12.5 teaspoons daily of added sugar, respectively, (26) which is considerably higher than the American Heart Association (AHA) recommended maximum of approximately 10.7 teaspoons for men and 6.25 teaspoons for women (18). These behaviors combined with a genetic predisposition for insulin resistance and beta-cell dysfunction create a perfect storm for high rates of obesity and metabolic disease that are observed in the US Latino population (27). There is a need for strategies targeted towards the Latino that aim to modify these behaviors in an effort to reduce disproportionate obesity and diabetes rates among this group.

Behavioral lifestyle interventions have proven to be efficacious for improving diet and PA habits and preventing the development of type 2 diabetes and other obesity related co-morbidities in a variety of populations and settings (28-31). Behavioral lifestyle intervention have varied considerably in their methodology, but successful interventions are typically tailored to the target population and implement a range of

behavior change strategies including goal setting, self-monitoring, skill building, modeling, reinforcement, problem solving and relapse prevention to target and change health behaviors (32-34). In order to maximize the success of this model for targeting the Latino populations, researchers must consider the unique needs and cultural values of these groups. Previous research indicates that interventions should be culturally grounded and delivered in community settings with participation from community collaborators that have gained the trust of the community (35-38). It is also important to consider the family roles and responsibilities of the individual as these roles have been consistently shown to influence health behaviors among Latinos (39). *Familismo*, defined as the importance of family and maintaining close family relationships and familial cohesiveness is an important Latino cultural construct (39). During the last 30 years there has been a growing body of research studies focused on targeting parents and children together for diet and PA behavior change to address this in the general population (40-42). However, behavioral lifestyle interventions targeting Latino families are lacking (43) and most studies using this approach only target and report on child outcomes (44-46). More research is needed for evaluating the efficacy for using a family-based model for modifying parental behaviors as well. Parent behaviors and outcomes are important as parents serve as role models, facilitators and "agents of change" for children, and parent behaviors are associated with children's behaviors (47-49).

Purpose of Research

The purpose of this study was to test the preliminary efficacy of a family focused, behavioral intervention promoting improvements in diet quality and habitual PA among parents with elementary school-aged children in a community with a high proportion of

Latinos. *Athletes for Life* (AFL) is a culturally grounded, 12-week lifestyle intervention informed by previous research, experience with the community, and behavioral theory (50-52). The intervention was delivered at South Mountain Community Center, which is located in an area of South Phoenix with a majority Latino population (>60%). The intervention was developed drawing from principles community-based participatory research (CBPR) and utilized continuous iteration for intervention improvement and optimization (53). The project began with focus groups which informed a feasibility study and was followed by a proof of concept study which have informed the current efficacy trial. During each phase feedback was solicited from participants and intervention components were modified accordingly. This iterative approach has allowed for tailoring of the intervention to meet the unique needs of the target population, while maintaining a theory based approach.

For this randomized controlled trial families were randomly assigned to an immediate AFL intervention group or a wait-list control group to examine the efficacy of the intervention for modifying parent behaviors including consumption of fruit, vegetables, and added sugars, and habitual MVPA. Heart rate response to an exercise test, body composition and cardiometabolic disease risk factors were additionally assessed as exploratory outcomes. Further, child MVPA, diet, heart rate response to exercise, and anthropometrics were also assessed along with the home environment. The current study is focused specifically on the intervention and outcomes related to the parents who participated in this program. Therefore, all methods and data reported herein pertain to the parents.

Aims and Hypotheses

Primary Aim 1: To investigate the efficacy of the 12 week AFL intervention for increasing fruit and vegetable consumption and reducing added sugar consumption among parents who participate in the intervention group compared to the wait-list control group.

Hypothesis 1: There will be improvements in dietary habits among intervention group parents as evidenced by increases in self-reported fruit and vegetable intake, and a reduction in sugar intake relative to the wait-list control group.

Primary Aim 2: To investigate the efficacy of the 12 week AFL intervention for improving fitness and MVPA relative to the wait-list control group.

Hypothesis 2: There will be an improvement in fitness as evidenced by reduced heart rate during the YMCA step test, and increased accelerometer and self-reported MVPA among the intervention group relative to the wait-list control group.

Exploratory Aim 1: To investigate the efficacy of the 12 week AFL intervention for improving body composition relative to wait-list control group.

Exploratory Hypothesis 1: There will be improvements in body composition as evidenced by reductions in body weight, percent body fat, and abdominal fat mass in the intervention group relative to the wait-list control group.

Exploratory Aim 2: To investigate the efficacy of the 12 week AFL intervention for improving cardiovascular disease risk factors among the intervention group relative to the wait-list control group.

Exploratory Hypothesis 2: There will be improvements in cardiometabolic disease risk as evidenced by improvements in fasting insulin, glucose, and lipids among the intervention group relative to the wait-list control group.

CHAPTER 2

REVIEW OF THE LITERATURE

Sharp increases in the rates of obesity and type 2 diabetes are overwhelming the health systems of the US (54-57). Modification of diet and activity behaviors has proven to be a safe and efficacious method for reducing obesity and preventing the development of type 2 diabetes (28, 58-61). A challenge is that behavior modification is complex. Interventions that target multiple levels of influence (e.g. personal, interpersonal) and address the unique needs of the target population are more likely to have success (62, 63). Interventions involving multiple family members are a unique way to leverage personal and interpersonal levels of influence for behavior change and have been shown to be at least as effective as individually targeted interventions (64, 65).

Latinos, the largest and fastest growing minority subgroup in the US, experience disproportionately high rates of obesity and type 2 diabetes (3, 10, 13). A variety of intervention strategies have been used to modify diet and PA behaviors to reduce weight and prevent type 2 diabetes among Latinos (28, 66, 67). However, few of these interventions have utilized a family-based approach (28). In this Chapter relevant literature pertaining to lifestyle intervention with Latino families will be reviewed. This will include a description of Latino health disparities, potential contributors to health disparities, the role immigration and acculturation play in these disparities, and the characteristics of the Latino family that may make tailored interventions a beneficial approach to behavior change with this group. This will be followed by a section describing successful behavioral lifestyle interventions among the general population and highlighting factors that have contributed to the success of these programs. Next,

challenges to delivering interventions with the Latino population will be described, followed by an overview of interventions that have overcome these challenges and delivered successful interventions. The final sections of the chapter will review intervention studies that have targeted Latino families for behavior change with a specific focus on studies that have reported outcomes for Latino adults.

Health of Latinos in the United States

Latino Population Trends

Latinos are the largest and fastest growing minority subgroup in the US. In 2010, there were almost 52 million Latinos in the US accounting for16.6% of the total US population (68). By the year 2050, the number of Latinos in the US is expected to rise to 128 million or 29% of the total population (13). The staggering population growth among Latinos is expected to account for 60% of the nation's total growth between 2005 and 2050 (13). This growth will also bring about a change in the generational composition of the Latino population. Between 1970 and 2000 Latino population growth was driven primarily by immigration. In the 21st century this trend has shifted and Latino births in the US now accounts for the majority of population growth (13). The result is a Latino population with a higher proportion of US born residents which has important implications for Latino population health.

Disparities in Obesity and Type 2 Diabetes among Latinos

Latinos experience higher rates of obesity and type 2 diabetes compared to non-Latino whites (3, 7-10). The prevalence of obesity among Latino adults is 25% higher than among non-Latino whites (42% vs 33.7%), while children have a 59% higher

prevalence of having a BMI above the 95th percentile (22.4% vs. 14.1%) (3). The ethnic differences in excess weight are greatest among the youngest groups as 4.5 times more Latino children 2-5 years of age have a BMI at or above the 95th percentile (16.7% vs. 3.5%) and twice as many Latino children 6-11 years of age are at or above the 95th percentile (26.1% vs. 13.1%) (3). In addition, the prevalence of diabetes among Latino adults is almost 70% higher than among non-Latino whites and Latino children and adolescents are three times as likely to develop type 2 diabetes (11, 12). Insulin sensitivity is also lower among Latino children and the prevalence of non-alcoholic fatty liver disease is higher among Latinos than non-Latino whites (69, 70). An overarching goal of Healthy People 2020 is to reduce disparities and achieve health equity among all groups (71). Meeting this goal will require narrowing and eliminating these gaps that exist between Latinos and their non-Latino white counterparts.

Contributors to Latino Health Disparities

The causes of Latino health disparities are multi-factorial and involve complex interactions between genetic, socio-cultural, and behavioral factors (27). Several genetic variants that contribute to the development of type 2 diabetes among Latinos have been identified (72). However, the inherited susceptibility to disease is not causal and lifestyle factors have the capacity to protect against disease development or exacerbate genetic susceptibility.

Socio-culturally, Latinos experience high rates of poverty and lower access to health services that may also contribute to the health disparities outlined above. The poverty rate among Latinos is twice that of their non-Latino white counterparts and Latinos not only have lower access to healthcare, but they utilize it less frequently and

report receiving lower quality of healthcare compared to non-Latino whites (73-75). Language and cultural barriers may prevent Latinos from seeking preventive care and managing existing conditions. Data from the San Antonio Heart study showed that Latinos with type 2 diabetes had almost double the mortality rate than non-Latino whites (76). Although genetic and socio-cultural factors may contribute to morbidity and mortality, behaviors are shown to be the greatest modifiable risk factors of disease and premature death (77). Modifying behavioral contributors to Latino health disparities is likely to have the greatest potential for reducing the burden of obesity and type 2 diabetes among this group.

Positive energy balance is a key underlying determinant of obesity and type 2 diabetes (78, 79). Low levels of PA and poor dietary habits are associated with substantially increased risk of obesity, type 2 diabetes, and related co-morbidities (16-22, 80). Hu et al. (80) followed 84,941 women for 17 years and reported 90% lower incidence of diabetes among women who met each of the following criteria: dietary score in the upper 40%; 30 minutes of MVPA daily; and BMI less than 25 kg/m^2. For this study the diet score was determined by adherence to a diet low in trans-fat and glycemic load and high in cereal fiber with a high polyunsaturated to saturated fat ratio. Results from the same longitudinal study suggested the incidence of diabetes was almost 2.5 times higher for women in the lowest quintile of PA compared to those in the highest quintile (20). Data from the Cooper Center Longitudinal Study showed that being in the highest tertile of cardiovascular fitness reduced the risk of diabetes by 50% among 6,249 women followed for 17 years (19). A prospective study of over 90,000 women followed for approximately 7 years demonstrated that women who consumed at least 1 sugar-

sweetened beverage per day had 80% higher risk of developing diabetes than those who consumed <1 beverage per month (81). Additionally, consumption of at least 5 servings of fruits and vegetables per day was associated with a 29% reduction in diabetes risk among 9,661 adults who were followed for approximately 20 years (82).

Latinos exhibit low levels of PA and poor dietary habits relative to national recommendations, although these behavioral patterns are not significantly different from those observed among non-Latino whites. Data from 2000-2003 indicate that over 50% of the Latino population reported no leisure time PA (23). Accelerometer data collected during NHANES 2003-2004 demonstrated that Latino men and women age 20-59 averaged only 10.5 and 6.1 minutes per day of MVPA while non-Latino whites in this age group averaged 8.8 and 6.5 minutes among men and women respectively (24). These figures are well below national recommendations of at least 150 minutes per week (83). Data from the National Health and Nutrition Examination Survey (NHANES) indicated that in 2003-2004 only 6.6% and 10.2% of Latinos were consuming the recommended amounts of fruits and vegetables, respectively (25). Among non-Latino whites these numbers were 5.5% for fruits and 5.6% for vegetables. Pooled data from NHANES 2003-2004 and the National Health Interview Survey (NHIS) 2005 indicated that Latino men and women were consuming approximately 18 and 12.5 teaspoons daily of added sugar, respectively (26). This is considerably higher than the American Heart Association's (AHA) recommended maximum of approximately 10.7 teaspoons for men and 6.25 teaspoons for women, but not different than non-Latino whites men and women who consume18.8 and 12.6 teaspoons daily of added sugar, respectively (18). Despite these similarities in health behaviors, health disparities among Latinos remain. Greater insight

about the contributors of these disparities may be gained by further examining Latino population characteristics.

Role of Acculturation in Latino Health

Despite the previously outlined disparities in diabetes and obesity, Latinos in the US experience lower rates of mortality than non-Latino whites (84). This phenomenon is referred to as the "Latino mortality paradox" and is a topic of great controversy and exploration among public health researchers. Some evidence suggests that this paradox may be attributed to the "salmon bias", which refers to Latinos returning back to their home country as they near death (8). There is also evidence of misreporting of Latino origin on death records, which may occur in up to 15-20% of Latino deaths (8). Nevertheless, the evidence supporting these theories is mixed and inconclusive, and there is a general consensus that there is in fact a survival advantage among the Latino population (85).

Another possible narrative to explain the Latino health paradox is one of immigration, resilience and preservation of cultural traditions. Immigrants who make the choice and have the capacity to immigrate to the US are naturally more inclined to be generally healthy individuals, and their arrival to the US likely produces immediate and significant improvements in living and environmental conditions in contrast to their home country (8). Latino immigrants are also more likely to work in physically active occupations and to engage in physically active methods of transportation, which may provide the necessary health protective PA that many US born citizens are lacking (86, 87). In addition, dietary patterns of the origin country are typically maintained after migration, protecting Latino immigrants from the deleterious effects of consuming the

standard American diet (7). Latinos with higher US acculturation report lower consumption of fruits and vegetables, higher consumption of added sugars and sugar sweetened beverages compared to less acculturated Latinos (88).

These findings suggest that as the Latino population shifts to include a higher proportion of US born and second and third generation Latinos, with greater acculturation to the US lifestyle, there may be a reduction in the factors that have protected first generation immigrants (13). This could lead to a reversal in the survival advantage that has been reported in the literature previously and may result in greater disparities in chronic disease among this rapidly growing population (89). As a result, there is a need for strategies targeted towards the Latino population to improve diet and PA habits in order reduce currently reported disparities and prevent the health crisis that may be looming.

Latino Family Characteristics

In the US, Latinos are more likely to live in a family household, one that includes family members related by blood or marriage, than non-Latino whites (90). Cultural norms and values moderate family characteristics, therefore, interventions that aim to target a high proportion of Latino families should take into account the norms and values of this population sub-group to maximize potential for success (91, 92). Two key elements that are characteristic in Latino families are *familismo* and *respeto (93, 94)*. *Familismo* is used to describe strong family ties and responsibility to place family needs above individual needs (93, 94). This is evident, as one of the most commonly cited barriers to exercise program participation are family and household responsibilities (95-97). This cultural trait can be leveraged to promote healthy behaviors by encouraging

family activities and emphasizing the importance of a parent making healthy lifestyle choices to set an example as well as maintain good health to maintain capacity to care for children and grandchildren. *Respeto*, translated respect, refers to respecting elders and also the family role and is taught to, and expected of, Latino children at a young age (93, 94). This cultural attribute can be leveraged by encouraging parents to establish strong identification as the provider of food and the decision maker with regard to food choices.

It is also important to consider is how Latino parent feeding habits differ from other cultures. There is evidence to suggest that Latino parents are more likely to require their children to finish all of the food on their plate then African-American and non-Latino white parents (98). There is also evidence that Latino parents are more likely to exhibit an authoritarian feeding style relative to African-American or non-Latino white parents which is associated with higher intakes of fruits and vegetables (99). Culturally sensitive programs should aim to leverage these patterns in family functioning and feeding style to achieve maximum success.

Behavioral Lifestyle Interventions

Behavioral Lifestyle Interventions for Chronic Disease Prevention

Behavioral lifestyle interventions have proven to be efficacious for improving diet and PA habits and preventing the development of type 2 diabetes and other obesity related co-morbidities in a variety of populations and settings (28, 30, 31, 61). The Diabetes Prevention Program (DPP), one of the most well-known and well-designed large scale studies, demonstrated the potential for a reducing diabetes incidence with lifestyle intervention. In the DPP 3,234 pre-diabetic participants were randomized to one

of three groups: 1) intensive lifestyle intervention, 2) metformin, 3) standard lifestyle recommendation comparison group (100). The lifestyle intervention consisted of a 16 session core curriculum delivered individually by a case manager over 6 months followed by a maintenance phase that included monthly telephone contact, bi-monthly face to face contact, and quarterly group sessions for the remainder of the study. The goal of the intervention was to achieve 7% weight loss and to accumulate 150 minutes per week of moderate intensity activity. The 16 core sessions provided information about diet, exercise and behavioral strategies self-monitoring, goal setting, stimulus control, problem solving, and relapse prevention training. The curriculum was individualized for each participant by the case manager and a toolbox of strategies that included incentives and loaning exercise tapes and equipment was used when participants were failing to meet their goals. Two supervised group exercise sessions per week were provided to help participants achieve their exercise goals (101).

The intensive lifestyle intervention in the DPP reduced the percent of individuals who converted from pre-diabetes to full blown diabetes by 58% relative to the control group and by 39% relative to the metformin group (100). At the end of the 1 year intervention participants lost approximately 6% of body weight on average and 50% of the participants met the 7% weight loss goal. In addition, there was an increase in leisure time PA of about 7.5 MET hours per week (100). Subsequent analyses revealed that the program also reduced the incidence of the metabolic syndrome by 41% and 29% compared to the placebo and metformin groups, respectively. Program participants also experienced reduced blood pressure, increased HDL cholesterol and a reduction in the prevalence of a pattern B LDL phenotype (31, 102). This program has received great deal

of attention for its success in preventing the development of diabetes and improving cardiovascular disease risk factors. However, the high cost of the program ($3,540 per participant) has limited dissemination (103).

The results of the DPP sparked several efforts to disseminate this program to a wider population by reducing costs and making it available in community locations (104, 105). Through a partnership with the YMCA and UnitedHealth Group, Vojta et al. (105) were able to disseminate the DPP at a cost of only $400 per participant by using existing community resources, delivering the program in a group setting, and training YMCA staff to implement the program. At one year, a weight loss of 5%, similar to the original DPP, was achieved among the 1,723 pre-diabetic participants from 400 communities who completed the program (105). Unfortunately this study did not employ a control group and analysis was only conducted on those who completed the program, which did not account for the 28% of participants who dropped out.

The study conducted by Katula et al. (104) leveraged community resources and employed registered dietitians and community health workers to deliver the DPP at community locations. The study enrolled 301 participants who were randomized to participate in a group based DPP. Intent-to-treat analysis revealed a significant reduction in fasting glucose, fasting insulin, and body weight among the group that participated in the DPP relative to a control group who received two individual sessions with an RD to discuss weight loss, healthy eating, and PA. Weight loss among the intervention participants was approximately 5% (104). No cost data were reported for this intervention, however given the professional staff utilized (i.e. RD's), the cost was likely higher than what was reported by Vojta et al. (105).

Others have taken a similar approach to modifying behavior and reducing chronic disease risk. Stevens et al. (106) recruited 1191 pre-hypertensive (DBP 83-89 mm Hg) adults 30-54 years of age who were 10-65% above ideal weight to be randomized to participate in a weight loss intervention or a usual care control group. The Trials of Hypertension Prevention (TOHP) intervention was preceded by an individual counseling session and consisted of 14 weekly group meetings, followed by six bi-weekly group meetings for the first 6 months. Monthly group meetings took place from 6-18 months. After 18 months participants were given several choices to continue participating which included special group topics and individual counseling sessions. The goal of the intervention was a 4.5 kg weight reduction by reducing consumption of fat, sugar and alcohol, and increasing PA to 30-45 minutes of MVPA per day at least 4 days a week. Several behavior change techniques were taught to the participants including self-monitoring, goal setting, problem solving, stimulus-control, and enlisting social support (106). At 6 months, participants in the intervention group lost 4.4 kg compared to a gain of 0.1 kg for the control group. By 36 months intervention group participants regained most of this weight and total weight loss over 36 months was 0.2 kg, while the control group gained 1.8 kg. The development of hypertension was reduced by 42% at 6 months, 22% at 18 months, and 19% at 36 months (106).

In a follow-up to the previous study, Cook et al. (107) tracked individuals who had participated in the TOHP for 10-15 years after initial enrollment into the intervention to determine the effect of the intervention on cardiovascular events. A total of 3,126 participants enrolled in the study and were randomized and of these data were obtained for 2,415 (77%). There were 200 cardiovascular events among the cohort and the

intervention group had a 30% reduced risk of a cardiovascular events compared to the control group (107).

These examples outline successful behavioral lifestyle interventions for preventing major chronic disease. Dissemination of these and similar programs to large segments of at risk groups could have a major impact on population health. However, these studies have included mostly non-Latino white participants, which may limit their applicability to diverse groups. Latinos have higher rates of obesity and type 2 diabetes than non-Latino whites (3, 10). Thus, interventions targeting Latinos may have a greater impact on chronic disease prevention. Currently, the majority of studies implementing chronic disease prevention programs with the Latino population have study design limitations and fail to demonstrate long-term success (28, 108). There is a unique set of barriers and challenges associated with delivering behavioral interventions to the Latino population that should be considered when designing interventions with this group (109). Thus, future research should draw upon existing literature and adapt intervention strategies to meet the specific needs of the Latino target population.

Barriers to Behavior Change Interventions among Latinos

Barriers to intervention delivery with Latino populations must be overcome to enable successful recruitment and program implementation. High poverty rates among Latinos result in several factors that make intervention with this population difficult (75). Latinos are less likely than non-Latino whites to have a reliable source of personal transportation which can lead to inconsistent attendance at intervention programs (110). Offering programs at community locations easily accessible to public transportation is a way of overcoming this barrier. Latinos are also less likely to have consistent access to a

cell phone or a computer with internet, which can make communication for recruitment, reminders, and follow-up quite challenging (111). This is a difficult challenge to overcome, but collecting multiple phone numbers of family and close friends can assist and establishing and maintaining contact.

Language can also be a challenge to intervention delivery. Whereas Spanish is the dominant language for 38% of Latinos, an additional 24% are English dominant (112). Interventions targeting Latinos must have bilingual staff to accommodate this diverse group. Another potential barrier that has been reported in the literature is institutional distrust (113). Latinos, particularly undocumented immigrants, are likely to be deterred by the collection of personal information and bureaucratic processes. This barrier can be overcome by partnering with trusted community leaders or organizations and by employing lay health advisors or Latino research staff (113). While there are several barriers to conducting behavioral interventions with Latino populations, these barriers can be overcome through awareness and strategic planning.

Culturally Tailored Interventions

Cultural tailoring refers to designing interventions that are acceptable and appropriate to the cultural traditions of the target population (114). Cultural tailoring includes both surface and deep structure modifications (115). Examples of surface tailoring include delivering the intervention in the native language, giving PA and dietary recommendations that are culturally relevant to the target group, and having bilingual facilitators that belong to the target group. Examples of deep structure tailoring include leveraging cultural values in materials, social support, and family focused intervention

(115, 116). Research has shown that cultural tailoring increases program effectiveness in nutrition and PA interventions with Latinos (116), as will be described below.

Several groups have implemented culturally tailored interventions with success (117-120). In *Secretos de la Buena Vida*, Elder et al. (120) recruited 357 women to be randomized into one of three groups: 1) promotora plus tailored print material condition; 2) tailored print only condition; and 3) off the shelf material condition. The intervention consisted of weekly home visits or telephone calls from the assigned promotora and 12 weekly tailored newsletters. Promotoras, 28 Spanish speaking community members (mean age=55.2 years), provided support for behavior change and negotiated behavior change goals. The tailored newsletters were developed based on the individual's baseline BMI, dietary assessments, and stage of change. The first newsletter gave information about BMI compared to norms and encouraged goal setting accordingly. The remainder provided behavioral strategies for improving diet habits and included an activity card that encouraged the implementation of a behavioral strategy (e.g. self-monitoring, goal setting). The off the shelf materials were Spanish language materials developed by the American Heart Association, American Dietetic Association, and the American Cancer Society (120).

At 12 weeks the promotora group reported significantly lower adjusted intake of total energy (1287 kcal vs. 1436 kcal; $p<0.01$) and total carbohydrates (171 g vs. 187 g; $p<0.05$) relative to the control group. The promotora group also had significantly lower glucose (16.0 g vs. 21.1 g; $p<0.01$), fructose (16.9 vs. 22.7; $p<0.001$), total fat (43.1 g vs. 49.8 g; $p<0.05$), and saturated fat (14.4 g vs. 16.9 g) intake at follow-up relative to the tailored print only condition. Costs of the intervention were $9.00, $45.00, and $135.00

for the control, tailored print, and promotora conditions, respectively (120). This study represents an innovate approach to diet change among Latino populations. A major strength of this study is the emphasis that was placed on tailoring the intervention to the unique cultural and personal characteristics of participants.

In the Arizona WISEWOMAN project, Staten et al. (118) randomized 326 participants of the National Breast and Cervical Cancer Early Detection Program (age ≥ 50 years) into three groups: 1) provider counseling (PC); 2) provider counseling plus health education (PC+); or 3) provider counseling, health education and community health worker support (PC++). The PC intervention was delivered by a nurse practitioner at baseline, 6, and 12 months and consisted of the delivery of health education materials and recommendations for increasing PA to at least 150 minutes per week and increasing fruit and vegetable consumption to at least 5 servings per day (118). The PC+ included an additional referral to two health education classes (one nutrition, one PA) along with a monthly health newsletter. The PC++ intervention consisted of the elements of the PC+ intervention plus additional support for behavior change from a promotora. Among participants who completed the study (n=217), systolic blood pressure was significantly reduced (-5.1 mm Hg $p \leq 0.01$) among the PC++ group and total cholesterol was reduced among the PC+ and PC++ groups (-8.3 mm Hg and -10.9 mm Hg, respectively; $p \leq 0.05$). All three groups reported increased PA at 12 months (15.1, 22.6, and 22.8 min/week of MVPA for PC, PC+, and PC++, respectively; $p \leq 0.05$) (118).

In *Mujeres Felices por ser Saludables*, Fitzgibbon et al. (117) randomized 256 Latinas 20-40 years old to an 8 month culturally tailored multicomponent education program, or a control group. The multicomponent education program aimed to reduce fat

and increase fiber and increase breast self-examination and consisted of weekly 90 minute sessions delivered weekly for 8 weeks, bi-weekly for 2 months, and monthly for 4 months. The intervention was grounded in Social Cognitive Theory and the Transtheoretical Model (117). The control group received mailings with general health information at the same frequency as the intervention group sessions. Among individuals who completed the post-intervention assessments (n=195) intervention participants had a significant reduction in percent calories from fat (-1.9 % vs. 0.5 %; $p<0.001$) and a trend towards an increase in fiber consumption (+0.5 g vs. -0.9 g; $p=0.06$) (117).

Hovell et al. (119) examined the impact of a culturally tailored aerobic dance intervention on behaviors and cardiovascular disease risk factors among 151 sedentary Latina women 18-55 years old (97% Mexican-born). Participants were randomized to an exercise intervention that consisted of 90 minute group sessions that met 3 times weekly for 6 months or a control group. The group sessions consisted of 60 minutes of aerobic dance, and 30 minutes of nutrition education. The control condition received 18 sessions presenting topics unrelated to exercise diet or CV such as fire safety, earthquake readiness, and first aid (119). Among participants who completed 6- and 12-month measures (n=141), intervention group participants increased VO2 max by 17% ($p<0.01$) at 6 months and maintained this increase through 12 months. There was also a significant increase from baseline in the percent of participants who reported vigorous PA among the intervention group at 6 months (+40%; $p<0.001$) and 12 months (+10%; $p<0.05$) (119).

The heterogeneity of study characteristics among interventions in targeted towards Latinos makes it difficult to identify key components that may contribute to program success. Mier et al. (116) conducted a review of the literature and concluded that three

components that were associated with program effectiveness in nutrition and PA interventions targeting Latinos were: 1) bilingual and bicultural facilitators and materials; 2) literacy appropriate materials; and 3) family inclusion and social support. While nearly all 18 studies included in this review were appropriately tailored for language and literacy, only 8 of the 18 included the family (116). Strong family relationships are an important part of Latino culture and previous research has shown that family-based interventions that target parents may have direct and indirect benefits for multiple family members (28, 121). Therefore, further emphasis should be placed on including family in behavioral interventions targeting Latinos.

Family Approach to Behavior Change

Theoretical Foundation

An advantage to a family approach to behavior change is that it simultaneously targets two levels of behavioral influence, personal and interpersonal, as recommended by Stokols et al. (63) for approaching health behavior change from an ecological perspective. Although family can be defined broadly, the strength of family-targeted interventions relies on members of a family who share a home and, therefore, are both influenced by similar social and environmental contexts (52). Relationship dynamics between family members vary dramatically, therefore, this review will focus exclusively on the parent/caregiver and child/dependent relationship, the area where the majority of the research of this field has been conducted (122).

The reciprocal nature of parent child relationships and the influence on nutrition and PA behaviors is best explained within the framework of the social-cognitive theory

(50-52, 123). Social cognitive theory is a behavioral model that describes behavior through triadic reciprocal determinism between behavior, the individual, and their environment (51). Individual factors that influence behavior include thoughts, feelings and beliefs, while the environment includes social influences, and external stimuli (51). In social cognitive theory, individual and environmental factors exert influence and are influenced by behavior, however, the strength of the influence between factors is not equal (51). A family model of social-cognitive theory recognizes the powerful influence of the family and acknowledges this in its theoretical approach (52). As a result social-cognitive theory is a widely cited model as a theoretical framework for family-based behavioral interventions (40, 124, 125).

Social contexts exert strong influence on eating and activity behaviors (126). For many people, the immediate family (i.e. those living within a household) are a primary source of influence for these behaviors (99, 127). Parents play a major role in shaping diet and PA habits of their children in a variety of ways (99, 128-131). For example Bauer et al. (128) found that parent encouragement and care for fitness was associated with greater PA among children and adolescents. Parent television time has also been shown to strongly influence television watching among children (129).

Bere et al. (132, 133) found that accessibility of fruits and vegetables and parent intake were associated with fruit and vegetable intake among 1950 6th and 7th grade children and that accessibility and parent modeling were associated with consumption of fruits and vegetables among 896 5th and 6th grade children (132, 133). Hannon et al. (134) reported that among 282 families, the family food preparer's consumption of fruits and vegetables predicted fruit and vegetable intake of the rest of the family. In addition,

family meals were also associated with increased consumption of fruits and vegetables. Parenting style may also influence children's dietary habits. Indulgent or uninvolved feeding styles was associated with low fruit and vegetable intake among 715 children participating in Head Start (99).

Interestingly, having children also influences parent behaviors. Adults with children tend to be less active than adults with no children, and commitment to family obligations is a consistently cited barrier to PA participation among parents (135). Many parents also report that children exert a strong influence on grocery store purchases and family restaurant choice (136, 137). Efforts targeting families for behavioral change should leverage these points of influence to maximize success.

Evidence for Long-Term Benefit of Family Lifestyle Interventions

Two seminal works that helped to establish a methodological framework for developing successful family lifestyle interventions were conducted by Epstein et al. (138) and Golan and Crow (121). Epstein et al. (138) recruited 76 overweight children 6-12 years of age and their parents and randomized them to one of three groups: 1) parent and child focused group; 2) child-focused group; or 3) non-specific control. Participants were followed for 10 years. The intervention consisted of weekly sessions for 8 weeks followed by monthly meetings for six months. All families were taught to use the traffic light method, which classifies foods into red or stop, yellow or caution, and green or go foods, to reduce caloric intake and promote weight loss (138). Contracting, intensive self-monitoring, social reinforcement, and contingency management were all used as behavioral strategies for behavior change and weight loss. Families in the parent and child focused group were trained to set goals for both parents and children and apply

behavioral strategies to meet these goals. Families in the child-focused group were trained to focus goal setting and behavior change for the children. Families in the non-specific group received general training for weight loss and reinforcement for attendance in lieu of goal setting and attainment (138). Percent overweight, calculated as the (current weight/ideal weight) x 100, at 10 years was the primary outcome of this study.

Children who were randomized to the parent-and-child-focused behavioral intervention group had a reduction in percent overweight relative to non-specific-focused comparison group (-7.0% vs. +13.6%; $p<0.05$). Children randomized to the child-focused group gained less weight than the control group (+4.7% vs 13.6%), although there was no significant difference between these groups. There were no differences between groups in change in percent overweight among parents, who tended to lose weight up to 21 months followed by a gain and an increase in percent overweight by 120 months (138).

Golan and Crow (121) randomized sixty families with an obese child 7-12 years of age to a child- or parent-targeted behavioral intervention. In the parent targeted group parents attended 14 one-hour group sessions over the course of 1 year. The sessions focused on nutrition education, parental restructuring of the home food environment, problem solving, stimulus control, monitoring, coping, and developing an authoritative parenting style. The child-targeted group consisted of 30 one hour group sessions held over a one year period that discussed many of the same dietary and behavior change topics as the parent only group. The children in the child-targeted group were prescribed a 1500 kcal/day diet (121).

Reduction in percent overweight was significantly greater among the parent targeted group compared to the child-targeted group at the end of the 12-month program

(-14.6% vs. -8.4%; <0.03) and 1 year (-13.6% vs. 0%; $p<0.05$), 2 years (-15.0% vs. +2.9%; $p<0.01$), and 7 years (-29.0% vs. -20.2%; $p<0.05$) following program completion (121). There was also a significant difference between groups in the number of children who moved to a non-obese weight category during seven years (60% parent only vs. 31% child only) (121). There were also improvements in parent outcomes at 1 year characterized by a significant reduction in mothers' total- (-15.2 mg/dL vs. +1.7 mg/dL; $p<0.05$) and LDL-cholesterol (-9.9 mg/dL vs. +4.5 mg/dL; $p<0.05$) and fathers' percent overweight (-4.4% vs. +0.2%; $p=0.05$) and fasting glucose (-13.0 mg/dL vs. -0.1 mg/dL; $p<0.05$) among the parent group relative to the child group (139). Mothers in the intervention group also reported increased MVPA of 0.69 hours per week. Interestingly, changes in parent outcomes correlated with child outcomes demonstrating the importance of parent behaviors and improvements for affecting the entire family unit (139).

Although these two studies helped to provide a framework for developing interventions with a long-term impact, there are several limitations to generalizability that must be noted. First, both of these studies were held in pediatric clinics and both required families to have two parents involved in the study. Also the participants in the study by Epstein et al. (138) were over 90% non-Latino whites, while Golan and Crow (121) conducted their research in Israel, which limits its application to the US (121, 138, 139). Nevertheless, some key points can be taken from these landmark studies. The first is that long term improvements can be achieved in response to family-based behavioral intervention that use a variety of behavior techniques and are grounded in behavioral theory. A second important conclusion from these studies is that a focus on parents can improve child outcomes and there is a correlation between parent and child outcomes. It

is important for researchers to build off of the long-term success of these studies and adapt the methods towards more diverse populations.

Interventions targeting Latino Families

Several behavior intervention studies have targeted Latino families for improving weight, diet, fitness, and PA (41, 45, 46, 140-144). However, the majority of these studies have focused on outcomes in the children and have not reported on adults. For example, Barkin et al. (41) randomized 92 dyads of Latino parents and children (child age: 2-6 years) to *Salud Con La Familia,* a healthy lifestyle intervention, or a school readiness control condition (41). The intervention consisted of 90 minute sessions delivered weekly at a local community center for 12 weeks, focusing on improving diet and PA habits. The intervention was grounded in social-cognitive theory and was culturally tailored and delivered only in Spanish. Of participants who completed baseline and post-intervention measures (n=75), BMI among children in the intervention group was reduced by 0.59 kg/m^2 after adjustment for covariates relative to that of children in the control group (41).

Slusser et al. (142) randomized 121 preschool-aged children with BMI percentile higher than 50% whose parents identified as Latino to an immediate overweight prevention intervention or wait-list control group. This 15-17 week, culturally tailored intervention was delivered in Spanish at a community health center and consisted of 9 modules lasting 90 minutes each focused on parent training to control child weight. Among participants who completed the one-year follow up (n=81), there was a significant reduction in BMI z-score among children in the intervention group relative to those the control group (142).

Shaibi et al. (144) delivered *Every Little Step Counts*, a 12-week culturally grounded diabetes prevention intervention for Latino adolescents 14-16 years old with BMI $\geq 85^{th}$ percentile. This lifestyle intervention was grounded in social-cognitive theory and delivered by promotoras to 18 adolescents and their families at a YMCA. Group classroom-based interactive sessions focused on improving health rather than weight loss and participants were encouraged to complete out of class activities such as grocery shopping and meal preparation with parents. In addition, adolescents also participated in three 60-minute individual and group exercise sessions per week. The sessions included aerobic and resistance training with the goal of maintaining a target heart rate of 150 bpm. Among the 15 adolescents who completed pre and post-assessment measures, the intervention resulted in significant reductions in BMI percentile (-1.3%; $p<0.05$), dietary fat consumption (-39.4%; $p<0.01$), screen time (-46.4%; $p<0.05$), physical inactivity (-26.8%; $p<0.01$), along with significant increases in relative VO2 peak (+5.2%$p<0.01$) and insulin sensitivity (+29.2%; $p<0.05$) (144).

O'Connor et al. (143) randomized 40 parent-child dyads with a child 5-8 years old who had a BMI between the 85^{th} and 99^{th} percentile to participate in *Helping HAND* (Healthy Activity and Nutrition Directions) or a wait-list control group. *Helping HAND* was a 6-month intervention based on social-cognitive and parent theories delivered by promotoras in primary care clinics. Intervention families met with promotoras individually on a monthly basis to select one behavioral target from a menu of health behaviors (e.g. be more active, watch less TV, eat more fruit) and received a follow-up phone call from the promotora two weeks after the in-person meeting to discuss progress and barriers (143). Among children who completed the intervention (n=34), TV viewing

at follow-up, after adjustment for baseline TV viewing and demographic characteristics, was significant lower among the intervention group compared to the control group (14.9 h/week vs. 23.3 h/week; $p<0.05$). The intervention also produced a moderate, non-significant, reduction on consumption of fruit juice ($d=0.36$) and accelerometer measured sedentary time ($d=0.36$) among the intervention group relative to control (143).

As illustrated in this section, there is a diversity of successful intervention programs targeting Latino families that have resulted in positive outcomes among children (41, 45, 140-147). There is surprisingly much less evidence examining parent outcomes as a result of participation in family-based behavioral interventions despite evidence that parental changes have direct and indirect benefits for the whole family and the greater potential for immediate reduction in chronic disease risk among adults (66, 139). Given these results, family-based interventions should focus on improving bio-behavioral outcomes among parents as well as children (139).

Review of Family Interventions Targeting Latino Parents

Twelve studies with majority Latino samples that reported parent outcomes in response to family-base lifestyle intervention were identified and are summarized in Appendix A. These studies were diverse in study design, outcome measures, and intervention components, duration and intensity. Study characteristics are summarized in Table 1. Seven of the studies were randomized controlled trials (40, 65, 125, 148-151) and five followed quasi-experimental pre-post designs (124, 152-155). Regarding study outcomes, eight studies reported weight/BMI (40, 65, 124, 149, 151-153, 155) seven reported dietary intake (40, 124, 125, 149, 150, 152, 154) five reported PA (124, 125, 148, 152, 154), two reported fitness (40, 148), and two reported biochemical outcomes

(40, 155). Regarding intervention characteristics, nine of the studies included an exercise component (40, 65, 124, 125, 148, 151-153, 155) and six included some type of food preparation/tasting (40, 65, 124, 150, 152, 155). Intervention duration was 6-8 weeks for three studies (124, 154, 155), 12-16 weeks for seven studies (125, 148-153), and 12-months for two studies (40, 65). Positive intervention outcomes are summarized in Table 2. One study reported lower salt consumption (40), three studies reported reduced SSB consumption (124, 152, 154), three studies reported increase fruit and/or vegetable intake (152, 154), one study reported reduced glycemic load (149) and two studies reported a reduction in fat (149, 150). One study reported improved self-reported PA (152), one study reported increase PA measured by pedometer (124), two studies reported improved blood pressure (40, 155), one study reported improved glucose (155) and 5 studies reported improvements in BMI (65, 124, 149, 153, 155). Of the interventions that lasted 16 weeks or less, all interventions held weekly sessions, except for one in which intervention sessions were 3 times per week (148).

Table 1. Study Characteristics of Family-Based Interventions Targeting Latino Parents

Design	Outcomes	Intervention components	Intervention Duration
• 7 studies were randomized controlled trials (40, 65, 125, 148-151) • 5 followed quasi-experimental pre-post designs (124, 152-155)	• 8 studies reported weight/BMI (40, 65, 124, 149, 151-153, 155) • 7 reported dietary intake (40, 124, 125, 149, 150, 152, 154) • 5 reported PA (124, 125, 148, 152, 154), • 2 reported fitness (40, 148) • 2 reported biochemical outcomes (40, 155)	• 9 of the studies included an exercise component (40, 65, 124, 125, 148, 151-153, 155) • 6 included some type of food preparation/tasting (40, 65, 124, 150, 152, 155)	• 3 studies lasted 6-8 weeks for three studies (124, 154, 155) • 7 studies lasted 12-16 weeks (125, 148-153) • 2 studies lasted 12-months (40, 65)

Table 2. Outcomes of Family-Based Interventions Targeting Latino Parents

Diet	Physical activity/ fitness	Cardiometabolic disease risk factors	Adiposity
• 1 study reported lower salt consumption (40) • 3 studies reported reduced SSB consumption (124, 152, 154) • 3 studies reported increase FV intake (152, 154) • 1 study reported lower glycemic load (149) • 2 studies reported reduction in fat (149, 150)	• 1 study reported improved self-reported PA (152) • 1 study reported increase PA measured by pedometer (124)	• 2 studies reported improved blood pressure (40, 155) • 1 study reported improved glucose (155)	• 5 studies reported improvements in BMI (65, 124, 149, 153, 155)

Olvera et al. (148) randomized 46 Latino mothers of 7-13 year old girls to participate in *BOUNCE* (Behavioral Opportunities Uniting Nutrition, Counseling and Exercise), a 12 week family-based lifestyle intervention, or a low intensity comparison group. The *BOUNCE* intervention consisted of 90 minutes sessions, three times per week

that included 45 minutes of exercise and 45 minutes of nutrition and behavioral counseling. The intervention was grounded in social-cognitive theory and was delivered in community locations including community centers and schools. The control group received a similar intervention but met once weekly. Despite a very high intervention intensity among the intervention group, no changes in BMI, fitness or self-reported PA were observed at the 12-week assessment (148).

In the only other study that conducted a cardiovascular fitness assessment Nader et al. (40) randomized 206 Latino families of 5th and 6th grade children to a 12-month behavioral intervention or a passive control group. The intervention was delivered in schools during after-hours and consisted of 12 weekly 90 minute sessions followed by 6 maintenance sessions that were delivered over the subsequent 9 months. Sessions were grounded in social-learning theory and included 25 minutes of exercise together as a family, a 25-minute dietary education session (separate for parents and children), a 25 minute family behavior change session that consisted of goal setting, progress review, and problem solving, and a shared low salt/low saturated fat snack. The dietary education utilized the stoplight categorization, which classifies foods into red/stop, yellow/slow, and green/go categories, and specific sessions focused on lower saturated fat and salt intake. Fifty-four percent of the sample was Latino and data were analyzed separately according to ethnicity. Among Latino families, attendance was 58% and 49% during the intervention and follow-up sessions, respectively. One year follow-up data from Latino parents suggested the intervention resulted in significant improvements in systolic and diastolic blood pressure (-2.2 mm Hg and -3.3 mm Hg, respectively; $p<0.05$), 3-day salt score (-0.17 arbitrary units; $p<0.01$), and a food-frequency index (+0.224 arbitrary units;

$p<0.001$) indicating lower fat and salt consumption among the intervention group relative to controls (40). There were no changes in fitness or weight status among the intervention group relative to the control.

In a quasi-experimental study, Ziebarth et al. (155) also reported improvements in blood pressure among 47 Latino parents of pre-school aged children who participated in *We Can!*, an 8 week intervention aimed at improving dietary choices, increasing PA and reducing screen time. The intervention consisted of weekly sessions with 40 minutes of classroom based content (delivered separately for parents and children), 40 minutes of PA, and a healthy family dinner. The behavioral framework for the program was not reported, but it was mentioned that all educational sessions were delivered bilingually. Fifty-seven parents (89% female) from 47 families completed the study. At the end of the program parents experienced a significant reduction in systolic and diastolic blood pressure (-3.5 mm Hg and -2.4 mm Hg; $p<0.05$, respectively), body weight (-0.9 kg; $p<0.01$), BMI (-0.35 kg/m^2, $p<0.05$), waist circumference (-1.4 cm; $p<0.05$) and fasting glucose (-3.08 mg/dL; $p<0.05$) (155).

In another quasi-experimental study Klohe-Lehman et al. (124) also reported weight loss after an 8 week intervention with 235 overweight, low-income parents of 1-3 year old children recruited from WIC and public health clinics. The 2 hour, weekly intervention was delivered by Registered Dietitians and was comprised of a 15 minute weigh in, 30 minutes of low-to-moderate PA, and 75 minutes of discussion and activities. The study, grounded in social-cognitive theory, promoted a well-balanced nutrient rich diet. All participants wore pedometers and tracked their PA throughout the program to promote PA. Mothers who completed the study (n=91) lost 2.7 ± 2.8 kg ($p<0.001$), which

was sustained 16 weeks after program completion (-2.8 ± 4.9 kg, $p<0.001$). There was also a significant increase in pedometer steps/day (6024 vs 9869, $p<0.05$) as well as a reduction in self-reported sugar-sweetened beverage intake (1.6 servings vs. 0.7 servings; $p<0.001$), however there were no changes in fruit or vegetable intake. Weight loss in this group of overweight parents was more pronounced than reported by Ziebarth et al. and this is likely attributed to a longer intervention length (16 weeks vs. 8 weeks), longer sessions (120 minutes vs. 90 minutes) and higher BMI at entrance (35 kg/m^2 vs. 28 kg/m^2). A major limitation of this study was the retention rate (<50%) and the lack of control group (124) .

Davis et al. (153) also reported significant weight loss among parents of children 2-18 years of age with BMI greater than the 85^{th} percentile who participated in Healthy Hawks, a 12 week family-based nutrition and PA behavior change program. *Healthy Hawks* met once weekly at a clinic service hospital for 2 hours and included one hour of classroom based content delivered separately to parents and children and one hour of joint PA participation. Each weekly session covered a new behavioral, PA, and nutrition topic. The nutrition content utilized the stoplight method (see Nader et al., (40) above) to promote healthier choices. Of parents who completed post-intervention data collection and one year follow-up (n=144 and n=63, respectively) BMI was significantly lower (-0.41 kg/m^2 $p<0.001$) at 12 weeks, and approached significance at 1 year (-0.48 kg/m^2; $p=0.06$), relative to baseline values. Similar to the previous study high attrition rate (>50%) is a chief limitation to this study (153).

In a follow-up study conducted by Davis et al. (151), 80 parents were randomized to *Healthy Hawks Super*, a modified version of *Healthy Hawks* that focused on parental

behaviors for the first 6 weeks and child behaviors for the following 6 weeks, or a wait-list control condition (151). Among parents who completed the 12 week intervention (n=64), there were no differences in BMI reduction over the 12 weeks between the intervention and control groups (-1.6 kg/m^2 vs. - 0.6 kg/m^2; $p>0.05$) (151).

Cousins et al. (65) randomized 168 healthy Latino adults (20-100% over ideal weight) with at least one preschool-aged child to one of three conditions: 1) a comparison group that received information, but no contact; 2) an individual intervention for adults only; or 3) a family intervention that had simultaneous sessions for children and adults and included spousal participation. The intervention groups received *Cuidando el Corazon* a year-long intervention that consisted of 24 weekly classes followed by 6 monthly classes that included group exercise, cooking demonstrations, food tastings and behavior modification training. Among participants who completed all data collection (n=86) weight loss was greater among the family- and individual-based interventions relative to the control group at 3 months (-3.0 kg vs. 2.6 kg vs. -0.9 kg, respectively), 6 months (- 4.5 kg vs. 3.3 kg vs. -0.2 kg, respectively) and 12 months (- 3.8 kg vs 2.1 kg vs. -0.7 kg, respectively). Although non-significant, the results of this study suggest that family involvement increases weight loss among adults (65).

Sorkin et al. (149) also reported significant weight loss among 89 adult Latinas with type 2 diabetes who were randomized with their adult daughters to *Unidas por La Vida* or a control group. *Unidas por La Vida* was a 16 week lifestyle intervention modeled after the DPP that focused on achieving weight loss through calorie restriction and accumulating 150 minutes of MVPA per week. The intervention was delivered at two federally qualified health centers, and included 4 group sessions, 8 home visits, and 4

booster telephone calls. The group classes included recipe demonstrations and 20 minutes of PA and participants were taught to monitor their dietary habits as well as goal setting, problem solving, and relapse prevention. An intention to treat analysis pooling mother and daughter data was conducted demonstrated that the intervention group had significantly lower weight at follow-up (mothers, -3.5 lb vs. +1.3 lb; daughters -4.6 lb vs. -1.2 lb; $p<0.01$) than control participants. Intervention participants also reduced saturated fat intake (mothers, -2.4 g vs. +1.4 g; daughters, -3.4 g vs. -4.1g; $p<0.01$) and glycemic load (mothers, -14.0 g vs. +8.2 g; daughters, -15.8 g vs. -20.7 g; $p<0.001$) relative to the control group (149).

In a quasi-experimental design, Dickin et al. (154) observed significant changes in dietary patterns among 210 low-income parents of children 3-11 years old who participated in a study titled "*Healthy Children, Healthy families: Parents Making a Difference*!". This 8 week intervention was delivered at five Expanded Food and Nutrition Education Program sites. Educational sessions were held weekly for 90 minutes and focused on improving nutrition following 6 recommendations and developing an authoritative parenting style using 4 key strategies. Diet behaviors were reported on a 5-point Likert scale and parents reported significant increases in frequency of consumption of fruits (0.55), vegetables (0.49), low-fat dairy (0.69) and a significant reduction in soda intake (0.37) ($p<0.001$ for all). There was also a significant improvement in a parent and home environment scale (0.37; $p<0.001$). Despite the self-reported nature of outcome data for this intervention, the nature of intervention sites and the emphasis on parent training and parenting style are two strengths of the study. Previous research has shown that parenting style is an important factor related to child's food consumption (156).

Another quasi-experimental study conducted by Anderson et al. (152) documented improvements in diet behaviors among 55 parents of overweight children (BMI>85th percentile; 7-17 years old) who participated in *Taking Steps Together,* a 16 week lifestyle intervention. The intervention was delivered once weekly for 2 hours in community recreation centers to parents and children together. Each session included three 40 minute segments: cooking and eating, interactive education, and PA. Parents were allowed to set rules and guidelines to encourage ownership of the program and social media was utilized to enhance social support. At the end of the intervention participants self-reported significant changes in daily servings of fruit (+0.8), vegetables (+0.9), sugar-sweetened beverages (-0.6), an increase in the number of days per week achieving 30 minutes of PA (+1.3) ($p<0.01$ for all). There was also a reduction in self-reported computer use/television watching (-0.7 hours/day; $p<0.05$). No significant changes in BMI were reported, which could be attributed to the fact that the intervention did not emphasize weight loss or caloric restriction. Moreover, because dietary and PA data were self-reported and based on individual questions per behavior, it is difficult to determine if this intervention successfully resulted in behavior modifications (152).

Fitzgibbon et al. (150) randomized 38 parents with children 7-12 years of age to a 12 week cancer risk reduction intervention or a standard health information comparison group. The intervention consisted of weekly one hour sessions, attended by parents and children together, and focused on the adoption of a low-fat high fiber diet. Relative to control participants, intervention participants reported small, non-significant reductions in percent of energy from fat (-5%) and saturated fat (-1%). It is possible that the small

sample size limited the statistical power of this study for achieving statistical significance (150).

In a subsequent study, Fitzgibbon et al. (125) randomized 122 parents with pre-school age children to a family-based adaptation of a *Hip Hop to Health* program or an information only comparison group (125). Parents and children received separate interventions. The parent intervention consisted of 6 weekly 90 minute sessions that included 60 minutes of family nutrition and PA behavior change content and 30 minutes of PA participation. The intervention was grounded in theoretical frameworks of Social Cognitive Theory and the Health Belief Model and emphasized the importance of modeling and reinforcing healthy choices among children. Parents in both groups received information for 14 weeks that aligned with the child sessions. Among parents who completed the follow-up measures (n=61) there were no significant changes or trends towards improvement in any of the diet or PA variables assessed. Retention (<50%) and attendance (23 parents attended ≥1 session) were low, thus hindering the ability to assess program efficacy (125).

Summary and Conclusion

This chapter provided a rationale for conducting family-based behavioral interventions with Latinos and reviewed previous literature that have implemented interventions with Latino families. It is clear that Latinos are disproportionately affected by obesity and type 2 diabetes compared to non-Latino whites, and that behavioral strategies to improve nutrition and physical activity can help to eliminate disparities. The Latino population has specific characteristics that make cultural adaptations important for

successful intervention delivery to this population. Potential barriers must be identified and overcome, and cultural traditions should be leveraged to improve intervention success. One important aspect of the Latino culture is the strong family ties and collective identity association with family relationships. This offers a strong opportunity for behavior change interventions, as it leverages motivation as well as social influences and home environmental factors that can help to promote change among several members simultaneously.

There is a need for well-designed randomized controlled trials examining family-based interventions targeting Latino adults and their children simultaneously as a primary prevention for chronic disease risk. Currently, there is a scarcity of research examining these types of programs and there is significant heterogeneity and inconsistent reporting of intervention strategies used to promote behavior change. Many of these studies are not grounded in behavior theory and many rely on brief self-report measures that lack strong validity to determine if true positive outcomes are occurring. Future research in this field should aim to ground interventions in strong evidence based behavioral theory, and select strong and valid measures, opting for objective measures when feasible. It may also be beneficial for future research to focus interventions on specific high risk groups (e.g. obese children, pre-diabetic parents) in order to maximize the cost-benefit ratio. Continued research in this field should work to determine intervention strategies that can produce successful improvements in strong behavioral and biological measures in both parents and children. Further optimization family-based interventions is an instrumental for the reduction of health disparities among Latinos in forthcoming years.

CHAPTER 3

METHODS

The Athletes for Life Study

The current research is an ancillary study to a parent project: The Athletes for Life (AFL) Study. AFL is a randomized controlled trial evaluating the efficacy of a multi-component family-based nutrition and PA behavior change intervention on diet, PA, and risk factors for cardiovascular disease. The program was developed using elements of community based participatory research (CBPR) through a strong partnership between researchers at Arizona State University and leadership at South Mountain Community Center, a community center in South Phoenix, an area with a 63% Latino population (1), where the intervention is being delivered. The AFL intervention was informed by extensive formative research that included focus groups with members of the target population and two previous iterations of the intervention that were delivered in the Spring of 2013 (feasibility/acceptability study) and 2014 (proof of concept study) (unpublished observations).

For the current parent study, parent/child-dyads were recruited to participate and were randomly assigned to a behavioral intervention or a wait-list comparison group eligible to receive the intervention after completing data collection. Families were recruited through fliers that were distributed to all elementary schools in the Roosevelt School District, the school district that serves the South Phoenix community. Staff at the South Mountain Community Center, the intervention delivery site, also promoted the

program and families were contacted from a list of parents who had participated in a previous phase of this intervention or had expressed interest prior to the current recruitment phase.

The behavioral intervention consists of twice weekly 90 minute sessions that are delivered over 12 weeks. For children, each 90 minute session is composed of 80 minutes of PA participation along with 10 minute nutrition lessons. For parents, the sessions are composed of 45 minute health behavior change lessons with a primary emphasis on nutrition and dietary change and 45 minutes of PA participation. The overarching goal of the program is to improve health behaviors on a family level, and the role of the parents and the children within the family unit is emphasized in each of the lessons. The remainder of this dissertation will describe the methodology and results only as it pertains to the ancillary study, which encompasses only the methods and outcomes from the parents enrolled in the study.

Participants

Participants were adult parents (mother or father; ≥18 years) of at least one child 6-11 years of age willing to participate in this study. Both parents were invited to attend the intervention sessions. If both parents chose to attend the program, we asked the couple to identify one parent as primary program participant for data collection. Exclusion criteria were as follows: 1) pregnancy; 2) medical conditions requiring specialized dietary regimes (e.g., phenylketonuria, severe food allergies, kidney disease); 3) limitations against participation in PA; 4) participation in other diet or PA

modification programs; and 5) not available on the day and time of the sessions. All participants were explained the intervention and data collection protocols, were given the opportunity to ask questions about the project, and provided written informed consent (Appendix B) prior to study enrollment. This study was approved by the Institutional Review Board at Arizona State University (Appendix C).

Randomization

Due to the high number of Spanish speaking participants, an unbalanced randomization schedule was used to ensure adequate number of English participants in the intervention group. Spanish participants were randomized according to a 1.5:1 control to intervention schedule, while English participants were randomized according to a 1:2 control to intervention schedule. Further, one participant who was originally randomized to the Spanish language control group participated in the English language intervention. This participant is a church leader who helped to recruit participants and indicated a commitment conflict with receiving the intervention with the wait-list group. Therefore, a decision was made to accommodate her into the English language intervention classes since she was bilingual.

Intervention

Health Behavior Change Lessons

The health behavior change lessons mainly focused on nutrition and dietary change, but also presented strategies for behavior change as it relates to PA and the

United States PA recommendations (83) (Table 3). The nutrition content was guided by recommendations from the United States 2010 Dietary Guidelines for Americans (157) and the American Heart Association (158) and focused on increasing the consumption of minimally processed, nutrient-dense foods, with limited emphasis on caloric restriction and weight loss. Based on a large body of literature and recommendations for preventing cardiovascular and metabolic disease, primary emphasis was placed on increasing the quantity and variety of consumed F/V, and reducing intake of added sugars (18, 158). The PA content included education about the health benefits of PA, and training for PA self-monitoring and progressive goal setting, and the implementation of behavioral strategies for increasing PA. Participants were given instructions to set goals towards increasing their consumption of F/V progressively towards 7 servings daily, reducing the consumption of foods and beverages with high added sugar content to less than 2 servings each day, and accumulating 150 minutes of MVPA each week.

Table 3. Parent Health Behavior Change Intervention Outline

Class	Topic	Description
1	Introduction to Athletes for Life	Description of the program and introductions
2	Reaching Your Goals	Discuss goal setting and monitoring. Help participants set goals and begin to monitor progress towards their goals
3	Chronic Disease: Reducing Your	Present information about common chronic diseases related to lifestyle and describe strategies for reducing disease risk
4	Lifestyle Habits	Discuss the importance of making healthy eating lifestyle habits rather than quick weight loss solutions
5	Basics of Nutrition	Introduce basic nutrition concepts and use examples to demonstrate healthful dietary patterns.
6	F/V: The Power of Color	Describe how the color of fruits and vegetables affects the nutrient composition. Provide a chart of what body systems each color benefits
7	Reading Labels	Review the key items on the nutrition facts panel. Have participants practice making choices based on the nutrition facts and explaining why
8	Portion Control	Go over common portion sizes and have participants practice estimating portion sizes of common foods
9	Calories, Energy Needs, and Weight Loss	Discuss why it is important not to eat too many calories. Describe energy density of foods. Assist participants in estimating their caloric needs
10		
11	The Power of Positivity	Describe how being positive about their diet and lifestyle habits can contribute to successful adoption of a healthy lifestyle
12	Controlling Blood Sugar	Discuss blood sugar and chronic disease. Describe glycemic effect of foods.
13	Controlling Blood Fats	Discuss how fat in the blood relates to heart disease. Describe key foods that help to improve lipids and avoid heart disease
14	Meal Planning and Grocery Shopping	Assist participants in planning a weekly meal plan and grocery list
15	Healthy Home Environment	Describe the importance of the environment for making smart diet choices. Give strategies for improving the home environment to support healthful eating
16	Reducing Screen Time and	Discuss television and activity. Set goals for reducing screen time and becoming more active over the next week
17	Smart Snacking	Provide a variety of ideas and recipes for snacks to replace high energy snack foods
18	Transforming Your Favorite Recipes	Provide guidelines for transforming recipes and practice making transformations to favorite recipes
19	Avoiding holiday Weight Gain	Discuss holiday weight gain. Describe how cutting calories around the holidays and making smarter choices can help to avoid weight gain.
20	Family, Friends, Food, and Fitness	Discuss the importance of sharing healthy food and physical activities with friends and family for maintaining long-term behavior change.
21	Maintaining	Review strategies for maintaining lifestyle changes for the long-term
22	Long Term Goals	Review long-term goals and have participants describe their current progress on goals.
23	Mindful Eating	Introduce the concept of mindful eating and give participants suggestions for eating more mindfully
24	Graduation Celebration	Potluck to celebrate the end of the program

This behavioral intervention was grounded in principles from social-cognitive theory (50) and operant conditioning (159) with strong emphasis on skill development, goal setting, positive reinforcement and behavioral self-monitoring (34, 160). A full list of strategies that were employed to promote behavior change in this intervention based on a previously published taxonomy (33) are available in Table 4. The lessons used facilitated discussions along with hands-on activities in order to deliver the content. The parent nutrition program facilitator handbook is included in Appendix D. The classroom content was delivered by a doctoral student in Nutrition and Health Promotion and a medical doctor from Venezuela in both English and Spanish, respectively.

Table 4. Behavior Change Strategies Employed in the Athletes for Life Study

Strategy	Method
Behavior self-monitoring	Participants tracked their consumption of fruits and vegetables, added sugar, and PA using worksheets from the participant handbook.
Goal Setting	Participants were prescribed long term program goals for F/V, added sugars, and PA and were guided through setting short term progressive goals to meet overall program goals.
Feedback	Participants were given feedback on goals, progress, self-monitoring activities and performance during all of the PA sessions.
Positive reinforcement	Participants were positively reinforced for attendance and participation as well as for reporting progress regarding nutrition or PA goals.
Social Support	The group format prompted social support from group members and participants were prompted to seek support for healthy behaviors from their friends, family, and coworkers. A Facebook group was also created for participants to share healthy meals and arrange activities together.
Environmental restructuring	Participants were given strategies for restructuring their environment to enable healthier choices throughout the intervention and one session was fully devoted to modifying the home environment to promote healthier choices.
Problem solving	Participants were prompted to think about barriers that made behavior change difficult and ways to overcome those barriers were discussed as a group.
Modeling	For PA, project assistants will guide each activity by first demonstrating how to properly perform each exercise. Nutrition modeling consisted of demonstrating easy ways to prepare healthy snacks and recipes.
Practice	PA was practiced at each session. Practice specific to nutrition behaviors included planning meals, making a grocery lists, reading food labels and preparing foods during the session.
Prompting identification as a role model	Throughout the program, topics were discussed in the context of the parent's role in the family. Parents were prompted to identify themselves as the "health ambassador" for the family.

PA participation

The active PA component primarily focused on modeling, practice and facilitated mastery of common and accessible exercises with the goals of developing self-efficacy for PA and improving physical fitness. Each 45 minute session focused on practicing a specific type of PA (e.g. cross training, Zumba, weight-lifting) to familiarize participants with readily available activities and help them develop skills for PA participation. At the

mid-point of the program (6 weeks) parents completed a one mile run and were given feedback about their performance on this measure relative to baseline.

Assessments

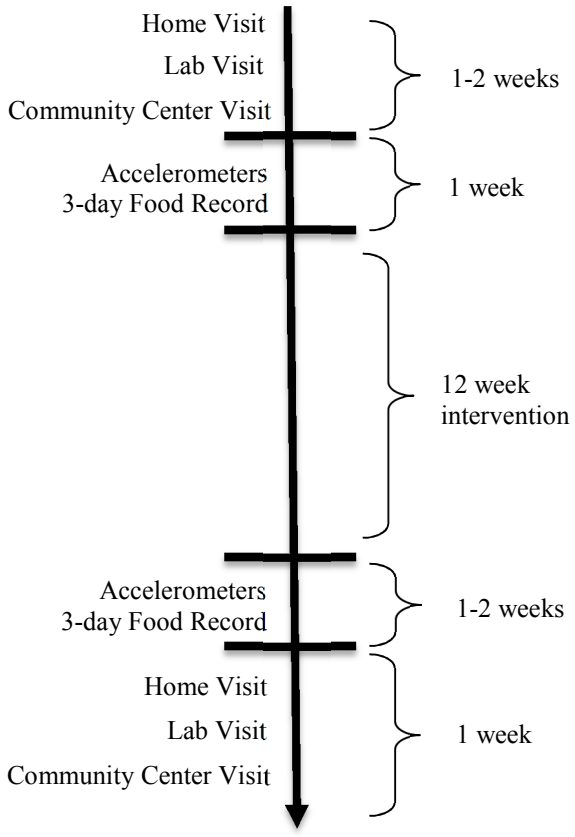
Data Collection Protocol

Data were collected at baseline and after the intervention (12.9±1.6 weeks from baseline) following identical protocols. At each time point, data were collected over two separate sessions: a home visit and a laboratory visit (Table 5). An illustration of the timeline for data collection is shown in Figure 1. The home visit was conducted by trained research assistants in participants' homes. This visit included completion of informed consent and administration of a survey (Appendix E) to collect socio-demographic and self-reported diet and PA data. For the laboratory visit, participants arrived at the School of Nutrition and Health Promotion Laboratory in Downtown Phoenix after a minimum 8-hour fast. Female parents were asked to provide a spot urine sample to verify they were not pregnant, to avoid potential for fetal radiation exposure during DXA scan (see below), using a commercially-available pregnancy test (Kurkel Enterprises, LLC, Redmond, WA).

Table 5. Data Collection Components

Measure	Baseline	Post-intervention
Home Visit		
Consent	x	
Survey	x	x
Laboratory Visit		
Blood Pressure	x	x
Anthropometrics	x	x
Biomarkers	x	x
DXA	x	x
Step Test	x	x
Community Center Visit		
One mile run		
Physical Activity		
Accelerometers	x	x
Dietary Intake		
Food record	x	x

Figure 1. Data Collection Flow Diagram



Participants then completed anthropometric, laboratory and fitness measures conducted by trained research assistants or appropriately licensed medical personnel when. In addition to the two visits, participants were asked to wear an accelerometer for 7 days for the objective measurement of PA (see below). They were also asked to complete a 3-day food record to assess dietary intake (Appendix F, see below).

Survey

The survey (Appendix E) included questions about sociodemographic characteristics (e.g. age, race/ethnicity, birthplace, generational status) and diet and PA habits. Consumption of fruits, vegetables, and soda were assessed with a one-item assessment for each food group. Participants were asked to estimate the frequency and quantity (servings) of consumption of each food group. In addition, participants were asked to indicate the number of days that they engaged in at least 30 minutes of moderate and vigorous PA and were also asked to estimate the time that they spend in sedentary activities (i.e. watching television, using the computer, driving). The sum of time spent in sedentary activities was calculated and an aggregate sedentary time score was generated from these variables.

Blood Pressure and Anthropometrics

After participants arrived to the laboratory they were asked to rest in a sitting position for five minutes before measurement of blood pressure. Blood pressure was measured on the left arm by trained research assistants in triplicate using an Omron IntelliSense HEM-907XL automated blood pressure monitor (Omron Healthcare, Inc., Bannockburn, IL). Body weight was measured in kilograms using a calibrated scale and

height was measured in centimeters using a wall-mounted stadiometer (SECA 284, Hanover, MD). Waist circumference was measured at the level of the umbilicus using a flexible tape measure. Weight, height, and waist circumference were measured in triplicate. Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2). Body composition was additionally assessed using dual energy X-ray absorptiometry (DXA; Lunar iDXA, GE Healthcare, Madison, WI). Percent body fat and visceral adipose tissue were analyzed using EnCore 13.0 software which estimates visceral adipose tissue by measuring the subcutaneous fat in the android region, defined as the region between the top of the iliac crest and 20% of the distance between the iliac crest and the base of the skill, and subtracting it from the total measured fat in the android region.

Biomarkers

A 26 ml blood sample was collected by venipuncture by a certified phlebotomist from the antecubital vein into evacuated tubes (serum separator tubes, EDTA, heparin, and fluoride/EDTA). All plasma tubes were placed in the refrigerator while serum tubes were allowed to clot for 30 minutes. All tubes were centrifuged at 3000 RPM at 4^{o}C for 15 minutes in an Allegra 6R refrigerated centrifuge (Beckman Coulter, Brea, California). Serum, plasma, and red blood cells were then aliquoted into microcentrifuge tubes and stored at -70^{o}C until analyzed upon completion of all baseline and post-intervention sample collection. Samples were used for the measurement of glucose, lipids, insulin, carotenoids, and total antioxidant capacity.

Plasma glucose and serum lipids (total, HDL, and LDL cholesterol, and triglycerides) were measured using the Cobas C111 automated chemistry analyzer (Roche Diagnostics, Indianapolis, IN). Serum insulin was measured using the ultra-sensitive human insulin radioimmunoassay kit (Millipore, Billerica, MA). Carotenoids were measured in heparinized plasma using high-performance liquid chromatography (HPLC; Waters Alliance® Instrument, Waters Corporation, Milford, MA) using previously published methods (161). Total anti-oxidant capacity of heparinized plasma was measured using a calorimetric assay kit (Cayman Chemical, Ann Arbor, MI) based on the measurement ABTS radical cation at 750 nm resulting from the interaction between hydrogen peroxide and metmyoglobin (162).

Cardiovascular Fitness

Cardiovascular fitness was assessed using a modified version of the YMCA three minute step test (163, 164). Participants wore a heart rate monitor (Polar FT1, Polar Electro, Kempele, Finland) for continuous measurement of HR throughout the protocol. To begin the test, participants rested in a sitting position for approximately five minutes to establish a baseline heart rate (HR). After HR stabilized, research assistants began recording HR at 15 second intervals for one minute. Participants were then instructed to complete three minutes of stepping onto and down from a 12-inch step to a metronome cadence programmed at 96 counts per minute (24 up and down cycles per minute). HR was recorded at 15 second intervals throughout the exercise. Immediately after the termination of the three minutes of exercise, participants were asked to sit down and heart rate was recorded in 15 second intervals during one minute of recovery. Average HR

during the baseline period and during each minute of exercise and recovery were calculated. In addition, estimated VO2 peak was calculated using a previously validated gender-specific equation [see below] (164). This equation predicted VO2 peak with R=0.83 and R^2=0.69 in a middle-aged overweight sample of adults (164).

Female: Estimated VO2 Peak = 76.3 + -0.37 (Age) – 0.15 (45s recovery heart rate) - 4.2

Male: Estimated VO2 Peak = 76.3 + -0.37 (Age) – 0.15 (45s recovery heart rate)

Dietary Intake

Three day food records, including two week days and one weekend day were collected from participants at baseline and post-intervention to assess dietary intake. Data were entered and analyzed using the Nutrition Data System for Research (NDSR), a computer-based software application developed at the University of Minnesota Nutrition Coordinating Center (NCC). The NCC Food and Nutrient Database serves as the source of food composition information in NDSR (165). This database includes over 18,000 foods including 8,000 brand name products. Ingredient choices and preparation methods provide more than 160,000 food variants. Values for 165 nutrient, nutrient ratios and other food components are generated from the database. The USDA Nutrient Data Laboratory is the primary source of nutrient values and nutrient composition. These values are supplemented by food manufacturers' information and data available in the scientific literature (166). Standardized, published imputation procedures are applied to minimize missing values (167).

Objective PA assessment

ActiGraph GT1M accelerometers (ActiGraph LLC, Pensacola, FL) were used to objectively measure time spent in ambulatory PA's of different intensities at baseline and post-intervention time points. The ActiGraph is a small, battery operated electronic motion solid state sensor (micro-electro-mechanical systems) designed to measure the rate and magnitude of body movement in a vertical plane (accelerations). Output data are digitized at a rate of thirty times per second with intensity data recorded in one minute epochs (sampling interval). The ActiGraph outputs data as counts per minute (cpm) that reflect: (a) the intensity of movement based on the frequency of acceleration deflections and (b) the duration of sustained period of the deflections. The ActiGraph GT1M has been validated as an accurate measure of energy expenditure when compared against the doubly labeled water method (168). Intensity of activity was categorized based on cut-points developed from controlled laboratory experiments as follows: sedentary (<100 cpm) (169), light (100-759 cpm) moderate (760-5725 cpm) and vigorous-intensity activities (>5725 cpm) (169, 170). The sum of minutes per day of moderate and vigorous PA (MVPA) over the days of valid wear time was calculated using these categories.

Participants were instructed to wear the ActiGraph over the right hip for seven days during all waking hours, only removing it to perform water-related activities (e.g., bathing, swimming). The ActiGraph was programmed to capture accelerations beginning at midnight of the day the instrument was provided to the participant. As determined previously by Matthews et al. (171), to characterize activity levels with at least 80% reliability participants needed to wear the ActiGraph continuously for 3-4 days to

characterize moderate- and vigorous-intensity movements. Consecutive accelerometer counts of zero for 60 minutes or longer was considered non-wear time and removed from time spent as daily wear time. Thus, ≥4 days (including one weekday and one weekend day) of data with counts recorded for ≥8 hours per day were required for inclusion in the analysis. Time spent at each PA intensity level is reported as the daily average among the days of valid wear time.

Statistical Analyses

Analyses were conducted only on participants who completed baseline and data collection. All variables are reported as mean values ± standard deviation (mean ± SD) or frequency where appropriate. Change scores were calculated by subtracting baseline values from post-intervention values, and differences in change between groups were calculated by subtracting control group change scores from intervention group change scores. Prior to analyses, Shapiro-Wilk tests and a visual inspection of the residuals and predicted values within each statistical model were performed to determine normal distribution. An analysis of covariance (ANCOVA) was performed to determine significant differences in post-intervention variables between groups controlling for baseline values and other relevant covariates. For diet data, previous intervention participation, gender, and total energy consumption (kcal) were used as covariates. For PA data, previous participation was used as a covariate. For anthropometrics, blood pressure, fitness and biomarkers for cardiovascular disease age, and gender were used as covariates. Baseline values were used as only covariates for TAC and carotenoids.

Significant within group changes over the intervention period was determined using paired T-tests when data were normally distributed and Wilcoxon signed-rank test when data were non-normal. Cohen's d, calculated as Δ *intervention* – Δ *control / pooled* σ, was used to estimate the effect size of the difference in change between groups. A p-value of <0.05 was used to determine statistical significance. All analyses were conducted using SPSS (Version 21, Chicago, IL).

CHAPTER 4

RESULTS

Participant Characteristics

Sixty-three potential participants were contacted through different recruitment avenues. Of these, 37 consented to participate in the study, and 33 completed all baseline data collection procedures. Five of these thirty did not complete post-intervention data collection (1 left for army reserve, 2 decided to discontinue participation, 2 unable to contact) giving a final sample of 28 participants (14 intervention; 14 control), yielding an 85% retention rate (Figure 2).

Sociodemographic characteristics of participants are presented in Table 6. Parents in the final sample were 37.9 ± 7.2 years, mostly female (93%), mostly Latino (93%) and foreign born (89%), mostly overweight (32%) or obese (57%), with 2.7 ± 1.5 children living in their household. Twelve parents (43%) had participated in a previous phase of AFL. Most participants were not employed (54%), most had completed high school (68%) and 43% were on state sponsored insurance coverage (AHCCCS). A higher percent of parents in the intervention group completed high school (86% vs 50%; ns) and had an income higher than 2500 (43% vs 21%; ns), but these differences were not significant. There were no significant differences between intervention and wait-list control participants in any sociodemographic characteristics at baseline. Participants in the intervention group attended 17.7 ± 5.0 sessions on average and 71% (n=10) of the participants attended at least 16 of 24 (66%) sessions.

Figure 2. CONSORT Flow Diagram

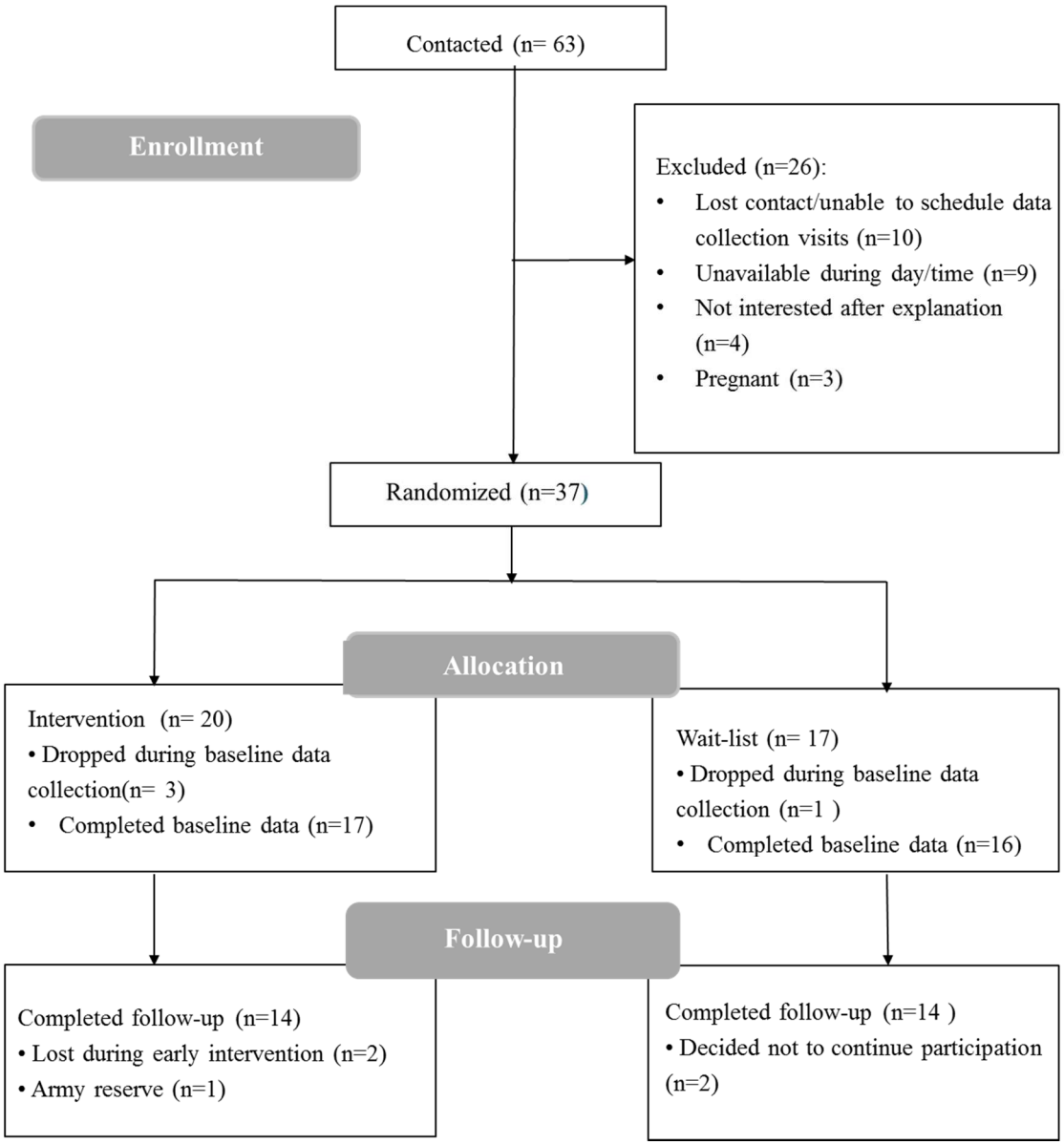


Table 6. Sociodemographic Characteristics of the Total Analytical Sample, Intervention, and Control Participants at Baseline[1]

	Total n=28	Control n=14	Intervention n=14	p-value[2]
Age (years)	37.9 ± 7.2	37.0 ± 6.8	38.8 ± 7.8	0.54
Female	26	13	13	
Latino	26	12	14	
BMI (kg/m^2)	31.8 ± 5.4	32.2 ± 5.9	31.3 ± 4.9	0.68
BMI categories				
Normal weight	3	1	2	
Overweight	9	6	3	
Obese	16	7	9	
Previous Participants	12	6	6	
Living with Partner	26	13	13	
Foreign-born	25	12	13	
Years in US (among foreign born)[3]	15.7 ± 6.0	13.6 ± 5.8	17.3. ± 5.9	0.16
Spanish language preference	19	11	8	
Household Size				
Adults	2.39 ± 0.8	2.5 ± 0.9	2.3 ± 0.7	0.51
Children	2.7 ± 1.5	2.8 ± 1.9	2.6 ± 0.9	0.71
Education				
Completed high school	19	7	12	
Completed 8th grade	4	3	1	
Less than 8th grade	5	4	1	
Household income ($)[4]	2829 ± 1644	2266 ± 1175	3443 ± 1906	0.09
≤1500	5	5	0	
1501-2000	3	1	2	
2001-2500	6	3	3	
2501-3000	2	1	1	
>3000	7	2	5	
Public Assistance				
SNAP/EBT/Food Stamps	7	4	3	
WIC	9	5	4	
Employment				
Full-Time	7	3	4	
Part-Time	6	3	3	
Homemaker/Unemployed	15	8	7	
Health Coverage				
AHCCCS	12	8	4	
Private	8	2	6	
No Insurance	8	4	4	

[1]Reported as M ± SD or n

[2]Differences between intervention and control participants were assessed using an independent samples t-test

[3] n=12 intervention; n=9 control

[4] n=11 intervention; n=12 control

Dietary Intake

Twenty-two of the 28 participants (79%) who completed baseline and post-intervention data collection completed a food record at each time point. One participant only had two days of data at post-intervention that included one week day and one weekend day and was included in the final sample. The remainder had three full days.

Nutrient intake data is summarized in Table 7. At baseline, participants in the intervention group reported consuming 1692 ± 321 kcal/d, 50% of which were provided by carbohydrates, 19% by protein and 32% by fat. Energy provided by fat was composed of 10% saturated, 12% monounsaturated, and 7% polyunsaturated fat. Fiber consumption was 21 ± 8 g/d, and total and added sugars were 81 ± 37 and 39 ± 31 g/d, respectively. For the control group, parents reported consuming 1727 ± 312 kcal at baseline composed of 51% carbohydrates. 19% protein, and 30% fat. Energy provided by fat was composed of 11% saturated, 12% monounsaturated, and 7% polyunsaturated fat. Fiber consumption was 19 ± 5 g/d and total and added sugars were 71 ± 20 and 36 ± 28 g/d, respectively. There were no significant differences between groups in nutrient intake changes as a result of the intervention. There were moderate effect sizes towards a reduction in percent of energy from carbohydrates (d=0.49) and an increase in percent of energy from fat (d=0.64) among the intervention group relative to the control group. A small to medium effect size towards an increase in grams of fiber consumed (d=0.36) was also observed.

Table 7. Pre- and Post-Intervention Nutrient Intake Assessed by 3-day Food Record Among Intervention and Control Participants[1]

	Intervention (n=10)	Control (n=12)	Difference in Change[2]	Cohen's d	p-value[3]
Total Energy (kcal)					
Pre	1692 ± 321	1727 ± 312			
Post	1606 ± 570	1491 ± 555			
Change	-85 ± 614	-235 ±	150 ± 203	0.31	0.49
Carbohydrate (% energy)					
Pre	49.8 ± 4.8	49.7 ± 4.2			
Post	47.7 ± 7.4	50.9 ± 6.7			
Change	-2.1 ± 7.6	1.2 ± 5.9	-3.3 ± 2.9	0.49	0.20
Protein (% energy)					
Pre	18.8 ± 3.0	18.4 ± 4.0			
Post	18.3 ± 3.5	19.0 ± 3.1			
Change	-0.5 ± 4.0	0.6 ± 3.6	-1.1 ± 1.6	0.29	0.54
Fat (% energy)					
Pre	31.5 ± 2.5	32.0 ± 4.8			
Post	34.0 ± 8.8	30.1 ± 5.8			
Change	2.4 ± 7.4	-1.9 ± 5.9	4.4 ± 2.9	0.64	0.13
Saturated Fat (% energy)					
Pre	9.8 ± 1.6	10.5 ± 2.6			
Post	10.1 ± 2.7	9.7 ± 2.1			
Change	0.3 ± 2.7	-0.8 ± 2.9	1.1 ± 1.2	0.39	0.50
Monounsaturated Fat (% energy)					
Pre	11.6 ± 7.2	11.7 ± 2.0			
Post	12.5 ± 3.3	11.0 ± 2.7			
Change	1.0 ± 4.0	-0.7 ± 2.6	1.7 ± 1.4	0.50	0.17
Polyunsaturated Fat (% energy)					
Pre	7.2 ± 1.7	7.1 ± 2.1			
Post	8.4 ± 3.7	6.6 ± 1.9			
Change	1.2 ± 3.5	-0.5 ± 2.6	1.7 ± 1.2	0.55	0.14
Total Fiber (g)					
Pre	20.7 ± 7.8	18.5 ± 4.8			
Post	22.2 ± 8.5	17.5 ± 5.6			
Change	1.5 ± 7.9	-1.1 ± 6.4	2.6 ± 8.9	0.36	0.26
Total Sugars (g)					
Pre	80.7 ± 37.0	71.3 ± 19.5			
Post	69.4 ± 29.7	65.5 ± 30.0			
Change	-11.3 ± 35.5	-5.8 ± 28.1	-5.6 ± 13.5	0.17	0.82
Added Sugars (g)					
Pre	39.2 ± 31.1	38.8 ± 27.9			
Post	33.4 ± 28.3	37.3 ± 29.7			
Change	-5.8 ± 17.2	-1..5± 29.3	-4.3 ± 10.5	0.18	0.70

[1]Reported as M ± SD

[2]Intervention - control group change (M ± SE)

3Differences in change in nutrient intakes were analyzed using an ANCOVA comparing post-intervention values adjusting for total kcal, previous participation and baseline value

[4]Significant ($p<0.05$) within group difference

Food group intake data is summarized in Table 8. For the intervention group mean total fruit and vegetable consumption was 5.3 ± 2.9 servings/d (2.1 ± 1.4 servings/d of fruit; 3.3 ± 2.0 servings/d of vegetables) and reported pastry and sweetened beverage consumption were low at 0.6 ± 0.7 servings/d and 0.4 ± 0.6 servings/d, respectively. For the control group total fruit and vegetables consumption was 3.5 ± 1.8 servings/d (1.1 ± 0.9 servings/d fruit and 2.4 ± 1.1 servings/d vegetables) and reported pastry and sweetened beverage consumption were 0.5 ± 0.4 and 0.8 ± 0.9 servings/d, respectively. There were no significant differences between groups in change in daily food group servings as a result of the intervention. There was a small effect size for a reduction in total vegetables (d=0.46) and a medium effect size for a reduction in pastries (d=0.72) among intervention participants relative to those in the control group.

Table 8. Pre- and Post-Intervention Food Group Intake Assessed by 3-day Food Record Among Intervention and Control Participants[1]

	Intervention (n=10)	Control (n=12)	Difference in Change[2]	Cohen's d	p-value[3]
Total Fruit and Vegetables (servings/day)					
Pre	5.3 ± 2.9	3.5 ± 1.8			
Post	5.4 ± 2.3	4.0 ± 2.4			
Change	0.0 ± 2.3	0.5 ± 2.6	-0.5 ± 1.0	0.2	0.48
Total Fruit w/ juice (servings/day)					
Pre	2.1 ± 1.4	1.1 ± 0.9			
Post	2.1 ± 1.4	1.3 ± 1.1			
Change	0.0 ± 1.5	0.1 ± 1.3	-0.1 ± 0.6	0.07	0.38
Total Vegetables (servings/day)					
Pre	3.3 ± 2.0	2.4 ± 1.1			
Post	3.3 ± 1.2	2.8 ± 1.9			
Change	0.0 ± 1.6	0.4 ± 1.8	-0.4 ± 0.7	0.23	0.70
Total Vegetables w/o potatoes (servings/day)					
Pre	3.1 ± 1.9	2.2 ± 1.2			
Post	2.8 ± 1.2	2.6 ± 2.0			
Change	-0.3 ± 1.3	0.4 ± 1.7	-0.7 ± 0.7	0.46	0.80
Pastries (servings/day)					
Pre	0.6 ± 0.7	0.5 ± 0.4			
Post	0.3 ± 0.5	0.5 ± 0.7			
Change	-0.4 ± 0.5	0.0 ± 0.6	-0.3 ± 0.2	0.72	0.31
Sweetened Beverages (servings/day)					
Pre	0.4 ± 0.6	0.8 ± 0.9			
Post	0.3 ± 0.3	0.6 ± 0.7			
Change	-0.1 ± 0.4	-0.2 ± 0.7	0.1 ± 0.2	0.18	0.56

[1]Reported as M ± SD
[2]Intervention - control group change (M ± SE)
3Differences in changes in food group servings were analyzed using an ANCOVA. Comparing mean differences at post adjusting for total kcal, previous participation and baseline value

Twenty-five participants (14 intervention; 11 control) of 28 participants completed the diet portion of the survey at baseline and post-intervention. One participant did not complete the diet survey at baseline, one participant did not complete the diet survey at post-intervention and another participant did not complete any part of the post-intervention survey. These results are presented in Table 9. Participants in the intervention group reported consuming significantly more fruits (+1.3 ± 1.4 vs. +0.3 ±

1.4; $p<0.05$) and vegetables (+1.5 ± 1.7 vs. 0.1 ± 1.2; $p<0.05$) at the end of the intervention compared to the control group. There were no differences in soda consumption between the intervention and control groups as a result of the intervention.

Table 9. Pre- and Post-Intervention Survey-Reported Intake of Fruit, Vegetables, and Soda Among Intervention and Control Participants[1]

	Intervention	Control	Difference in	Cohen's	p-
Fruit (servings/day)					
Pre	1.4 ± 0.8	1.1 ± 0.7			
Post	2.6 ± 1.4	1.4 ± 1.1			
Change	1.3 ± 1.4[4]	0.3 1.4	0.9 ± 0.6	0.71	0.03
Vegetables (servings/day)					
Pre	1.2 ± 1.2	1.1 ± 0.9			
Post	2.7 ± 1.7	1.3 ± 1.0			
Change	1.5 ± 1.7[4]	0.1 ± 1.2	1.4 ± 0.6	0.95	0.02
Soda (servings/day)					
Pre	0.1 ± 0.2	0.8 ± 1.2			
Post	0.1 ± 0.1	0.3 ± 0.3			
Change	0.0 ± 0.2	-0.5 ± 1.0	0.5 ± 0.3	0.69	0.58

[1]Mean ± SD

[2]Intervention-control group change (M ± SE)

[3]Differences in changes in anthropometrics and blood pressure were analyzed using an ANCOVA comparing mean differences at post adjusting for previous participation, total kcal, and baseline value

[5]Significant ($p<0.05$) within group difference; Wilcoxon-signed rank test.

Anthropometrics and Blood Pressure

Anthropometrics and blood pressure data were obtained for all 28 participants and are presented in Table 10. At baseline participants in the intervention group had a BMI of 32.2 ± 5.9 kg/m^2, body fat of 43.5 ± 6.2%, and systolic and diastolic blood pressure of 116 ± 13 and 73 ± 10 mm Hg, respectively. The control group had BMI of 31.3 ± 4.9 kg/m^2, body fat of 42.9 ± 5.9%, and systolic and diastolic blood pressure of 115 ± 22 and 71 ± 16 mm Hg, respectively. There were no differences in these variables between

groups at baseline. There was a significant reduction in percent body fat between baseline and post-intervention among the intervention relative to the control group. (-1.1 ± 1.2 vs. +0.2 ± 1.2; p=0.014). There was also a significant within group change in body weight among the intervention group (-1.1 ± 1.7 kg; $p<0.05$). There were also medium effect sizes for reductions in body weight (d=0.50), systolic blood pressure (d=0.31), diastolic blood pressure (d=0.28), and visceral fat (d=0.58) among the intervention group relative to the control group.

Table 10. Pre- and Post-Intervention Anthropometrics and Blood Pressure Among Intervention and Control Participants[1]

	Intervention (n=14)	Control (n=14)	Difference in Change[2]	Cohen's d	p-value[3]
Body Weight (kg)					
Pre	82 ± 18	77 ± 14			
Post	81 ± 17	77 ± 15			
Change	-1.1 ± 1.7[4]	-0.1 ± 2.4	1.0 ± 0.8	0.5	0.26
BMI (kg/m^2)					
Pre	32.2 ± 5.9	31.3 ± 4.9			
Post	31.8 ± 5.9	31.2 ± 5.1			
Change	-0.38 ± 0.8	-0.1 ± 1.2	-0.3 ± 0.4	0.27	0.56
Waist Circumference (cm)					
Pre	100 ± 15	97 ± 13			
Post	100 ± 15	97 ± 13			
Change	0.0 ± 5.7	0.9 ± 5.1	-0.9 ± 2.9	0.17	0.72
Body Fat (%)					
Pre	43.5 ± 6.2	42.9 ± 5.9			
Post	42.4 ± 6.7	43.0 ± 6.0			
Change	-1.1 ± 1.2[4]	0.2 ± 1.3	-1.2 ± 0.5	1.04	0.014
Visceral Fat Mass (g)					
Pre	1227 ± 646	1181 ± 655			
Post	1158 ± 624	1186 ± 709			
Change	-68 ± 121	5 ± 130	-73.4 ± 47.5	0.58	0.15
Systolic Blood Pressure (mm Hg)					
Pre	116 ± 13	115 ± 22			
Post	115 ± 10	119 ± 16			
Change	-0.4 ± 12.8	3.7 ± 13.6	-4.1 ± 5.0	0.31	0.67
Diastolic Blood Pressure (mm Hg)					
Pre	73 ± 10	71 ± 16			
Post	73 ± 8	75 ± 9			
Change	0.1 ± 9.4	3.3 ± 13.4	-3.2 ± 4.4	0.28	0.4

[1]Reported as mean ± SD
[2]Intervention - control group change (M ± SE)
[3]Differences in changes in anthropometrics and blood pressure were analyzed using an ANCOVA comparing mean differences at post adjusting for age, gender, and baseline value
[4]Significant ($p<0.05$) within group difference assessed with a paired t-test.

Cardiometabolic Disease Risk Factors

Biomarkers of cardiometabolic risk were obtained for all 28 participants with the exception of one participant in the intervention group who refused the blood draw for glucose analysis. The results are presented in Table 11. At baseline the intervention group

had total-, LDL-, and HDL-cholesterol of 182 ± 32, 126 ± 36, and 48 ± 12 mg/dL, respectively, triglycerides of 111 ± 67 mg/dL, glucose of 83 ± 6 mg/dL, and insulin of 18 ± 6 μ U/mL. The control group had total-, LDL-, and HDL-cholesterol of 165 ± 32, 115 ± 27, and 46 ± 6 mg/dL, respectively, triglycerides of 94 ± 39 mg/dL, glucose of 88 ± 11 mg/dL, and insulin of 19 ± 8 μ U/mL. There were no significant differences in biomarkers of cardiometabolic risk between groups. Although participants were obese, only 6 (21%) participants demonstrated the clinical manifestations of Metabolic Syndrome according to the ATP III criteria (172). No significant within or between group changes in biomarkers of cardiometabolic risk were observed. However, there were small to moderate effect sizes towards improvement in, triglycerides (d=0.38), and glucose (d=0.37) among the intervention group relative to the control group.

Table 11. Pre- and Post-Intervention Biomarkers for Cardiometabolic Disease Risk Among Intervention and Control Participants[1]

	Intervention (n=14)	Control (n=14)	Difference in Change[2]	Cohen's d	p-value[3]
Total Cholesterol (mg/dL)					
Pre	182 ± 32	165 ± 32			
Post	179 ± 46	166 ± 23			
Change	-3.0 ± 22.7	1.0 ± 24.7	-4.0 ± 9.0	0.17	0.85
LDL Cholesterol (mg/dL)					
Pre	126 ± 36	115 ± 27			
Post	126 ± 48	118 ± 22			
Change	0.1 ± 27.9	2.2 ± 20.6	-2.1 ± 9.3	0.09	0.98
HDL Cholesterol (md/dL)					
Pre	48 ± 12	46 ± 6			
Post	47 ± 12	43 ± 4			
Change	-1.8 ± 6.3	-2.5 ± 4.8	0.8 ± 2.1	0.12	0.64
Total /HDL Cholesterol Ratio					
Pre	3.9 ± 1.0	3.6 ± 0.7			
Post	4.0 ± 1.4	3.9 ± 0.6			
Change	0.2 ± 0.6	0.1 ± 0.7	0.1 ± 0.2	0.15	0.65
Triglycerides (mg/dL)					
Pre	111 ± 67	94 ± 39			
Post	101 ± 34	102 ± 41			
Change	-10.2 ± 57.3	7.8 ± 35.8	-18.0 ± 18.1	0.38	0.27
Glucose (mg/dL)[5]					
Pre	83 ± 6	88 ± 11			
Post	80 ± 7	88 ± 11			
Change	-2.5 ± 6.7	0.5 ± 9.3	-3.1 ± 3.1	0.37	0.35
Insulin (μU/mL)					
Pre	17.8 ± 5.9	18.7 ± 7.9			
Post	16.5 ± 4.5	18.1 ± 6.1			
Change	-1.2 ± 4.6	-0.7 ± 6.8	-0.6 ± 2.2	0.09	0.44
HOMA-IR[5]					
Pre	3.7 ± 1.4	4.2 ± 2.4			
Post	3.3 ± 1.0	4.0 ± 1.8			
Change	-0.4 ± -1.1	-0.2 ± 1.9	-0.2 ± 0.6	0.13	0.25
MetS (N[%])[6]					
Pre	3 (21)	3 (21)			
Post	2 (14)	3 (21)			

[1]Reported as mean ± SD

[2]Intervention - control group change (M ± SE)

[3]Differences in changes in biomarkers were analyzed using an ANCOVA comparing mean differences at post adjusting for age, gender, and baseline value

[4]Significant ($p<0.05$) within group difference

[5]n=13

[6]Presence of metabolic syndrome

Plasma Total Antioxidant Capacity and Carotenoids

Two participants in the intervention group refused the collection of heparinized plasma and one participant yielded only enough sample to measure carotenoids and not TAC, leaving final samples of 12 for carotenoids and 11 for TAC. These results are presented in Table 12. At baseline participants in the intervention group had a total carotenoid concentration of 3.43 ± 1.56 ug/mL, with lutein, lycopene, beta-cryptoxanthin, and beta-carotene concentrations of 0.42 ± 0.54, 2.43 ± 1.62, 0.27 ± 0.26, and 0.34 ± 0.24 ug/mL, respectively and a TAC of 2.2 ± 1.14 mmol trolox equivalent/L. The control group had a total carotenoid concentration of 3.45 ± 1.69 ug/mL with lutein, lycopene, beta-cryptoxanthin, and beta-carotene concentrations of 0.70 ± 0.68, 1.94 ± 1.33, 0.21 ± 0.19, and 0.59 ± 0.57 ug/mL, respectively, and a TAC of 1.67 ± 0.38 mmol trolox equivalent/L,. No significant within or between group changes in carotenoids or TAC were observed. Small to medium effect sizes were observed towards a reduction in TAC among the intervention group (d=0.31), an increase in total carotenoids (d=0.41), lycopene (d=0.49) and beta-cryptoxanthin (d=0.47).

Table 12. Pre- and Post-Intervention Plasma Total Antioxidant Capacity and Carotenoids Among Intervention and Control Participants[1]

	Intervention (n=12)[2]	Control (n=13)[3]	Difference in Change[4]	Cohen's d	p-value[5]
TAC[5] (mmol Trolox equivalent/L)					
Pre	2.20 ± 1.14	1.67 ± 0.38			
Post	1.71 ± 0.42	1.43 ± 0.34			
Change	-0.48 ± 1.01	-0.24 ± 0.46	-0.24 ± 0.30	0.31	0.40
Total Carotenoids (ug/mL)					
Pre	3.43 ± 1.56	3.45 ± 1.69			
Post	3.83 ± 2.42	3.15 ± 1.48			
Change	0.40 ± 1.68	-0.30 ± 1.70	0.70 ± 0.67	0.41	0.29
Lutein (ug/mL)					
Pre	0.70 ± 0.68	0.42 ± 0.42			
Post	0.66 ± 0.54	0.54 ± 0.52			
Change	-0.04 ± 0.63	0.12 ± 0.50	-0.16 ± 0.22	0.28	1.00
Lycopene (ug/mL)					
Pre	1.94 ± 1.33	2.43 ± 1.62			
Post	2.30 ± 1.93	2.07 ± 1.07			
Change	0.37 ± 1.58	-0.36 ± 1.40	0.72 ± 0.58	0.49	0.36
Beta-Cryptoxanthin (ug/mL)					
Pre	0.21 ± 0.19	0.27 ± 0.26			
Post	0.26 ± 0.27	0.22 ± 0.22			
Change	0.05 ± 0.15	-0.05 ± 0.26	0.10 ± 0.09	0.47	0.42
Beta-Carotene (ug/mL)					
Pre	0.59 ± 0.57	0.34 ± 0.24			
Post	0.62 ± 0.50	0.33 ± 0.36			
Change	0.03 ± 0.26	0.01 ± 0.22	0.04 ± 0.10	0.08	0.46

[1]Reported as mean ± SD
[2]11 for TAC
[3]14 for TAC
[4]Intervention - control group change (M ± SE)
[5]Differences in changes in carotenoids and TAC were analyzed using an ANCOVA comparing mean differences at post adjusting for baseline value
[6]Total antioxidant capacity

Physical Activity and Fitness

Valid accelerometer data was available for 16 participants (10 intervention; 6 control). Twenty-six had participants had data for at least one time point, but 8 participants five participants did not have baseline data and three did not have post-intervention data. Reasons for missing data included non-compliance and malfunctioning

devices. Detailed accelerometer data is presented in Table 13. Participants who had valid accelerometer data had on average 6.1 and 7.5 average days of wear time and 14.0 and 14.5 valid hours per day for the intervention and control groups, respectively. At baseline participants in the intervention group had 772.4 ± 62.7 minutes of sedentary time per day and 37.4 ± 27.0 minutes of moderate PA per day, 2.1 ± 2.4 minutes of vigorous PA per day, adding to 39.8 ± 28.9 minutes of MVPA. Participants in the control group had 759.7 ± 76.6 minutes of sedentary time per day and 18.4 ± 13.2 minutes of moderate PA per day, 1.0 ± 1.0 minutes of vigorous PA per day, adding to 19.5 ± 13.8 minutes of MVPA. There were no significant between or within group changes in any of the PA data categories. There were small to moderate effects towards an increase in moderate PA (d=0.53; p=0.31) and combined MVPA (d=0.47; p=0.32) among the control group and an increase in vigorous activity among the intervention group (d=0.35; p=0.42)

Table 13. Pre- and Post-Intervention Accelerometer Measured PA Among Intervention and Control Participants[1]

	Intervention (n=10)	Control (n=6)	Difference in Change[2]	Cohen's d	p-value[3]
Sedentary Time (min/day)					
Pre	772.4 ± 62.7	759.7 ±			
Post	768.1 ± 71.3	763.9 ±			
Change	-4.4 ± 46.1	4.2 ±	-8.6 ± 33.2	0.12	0.86
Light (min/day)					
Pre	326.8 ± 45.9	359.9 ±			
Post	331.6 ± 60.6	332.1 ±			
Change	4.8 ± 45.2	-27.7 ±	32.5 ± 29.9	0.52	0.30
Moderate (min/day)					
Pre	37.4 ± 27.0	18.4 ±			
Post	36.1 ± 34.9	27.8 ±			
Change	-1.3 ± 12.8	9.5 ±	-10.8 ± 9.5	0.53	0.31
Vigorous (min/day)					
Pre	2.1 ± 2.4	1.0 ±			
Post	2.9 ± 3.2	1.1 ±			
Change	0.8 ± 2.6	0.1 ±	0.7 ± 1.1	0.35	0.42
MVPA[4] (min/day)					
Pre	39.8 ± 28.9	19.5 ±			
Post	39.4 ± 38.1	29.0 ±			
Change	-0.4 ± 13.4	9.5 ±	-9.9 ± 9.8	0.47	0.32

[1]Reported as mean ± SD
[2]Intervention - control group change (M ± SE)
[3]Differences in changes in accelerometer-measured activity were analyzed using an ANCOVA comparing mean differences at post adjusting for previous participation and baseline value.
[4]Moderate and vigorous physical activity

Twenty-seven participants completed the PA section of the survey at baseline and post-intervention. One participant skipped this section. Self-reported PA data is shown in Table 14. Based on baseline self-reported survey data, participants in the intervention group reported accumulating at least 30 minutes of MVPA an average of 2.6 ± days over the past week, while participants in the control group reported 2.4 ± 2.0 days. This is not consistent with the accelerometer data that indicated that intervention group participants averaged over 30 minutes of MVPA each day and control group participants averaged

less than 20. There was a significant increase in reported days accumulating 30 minutes of MVPA among the intervention group relative to the control group (+0.8 ± 3.2 vs. -1.5 ± 2.3; p=0.004). This is also not consistent with the accelerometer data that shows no change in MVPA among the intervention group and a non-significant increase in MVPA among the control group.

Table 14. Pre- and Post-Intervention Self-Reported PA Among Intervention and Control Participants[1]

	Intervention (n=14)	Control (n=13)	Difference in Change[2]	Cohen's d	p-value[3]
Days with ≥30 min MVPA over the past week					
Pre	2.6 ± 1.7	2.4 ± 2.0			
Post	3.4 ± 2.6	0.9 ± 1.1			
Change	0.8 ± 3.2	-1.5 ± 2.3	-2.3 ± 1.1	0.83	0.004

[1]Reported as mean ± SD
[2]Intervention - control group change (M ± SE)
[3]Differences in changes in self-report PA were analyzed using an ANCOVA comparing mean differences at post adjusting for previous participation and baseline value.

Fitness and one-mile run time data are shown in Table 15. Step test data was collected for all of the participants, while one mile run was collected for 24 participants (13 intervention; 11 control). Missing data (1 intervention, 3 control) is the result of being unable to schedule a community center visit between the end of the program and Christmas. At baseline participants in the intervention group had resting, exercise, end of exercise, and recovery HRs of 70.3 ± 6.6, 124.3 ± 12.0, 141.9 ± 15.2, and 113.6 ± 15.8 bpm, respectively. Estimated VO2 max was 41.9 ± 4.5 ml/kg/min and one mile run time was 12.1 ± 2.8 minutes. The control group had resting, exercise, end of exercise, and recovery HRs of 69.9 ± 7.8, 126.1 ± 13.8, 142.2 ± 16.8, and 116.6 ± 15.0 bpm. Estimated VO2 max was 42.3 ± 4.2 ml/kg/min and one mile run time was 11.9 ± 2.4 minutes. There were significant reductions among the intervention group participants relative to those in

the control group in resting HR (-7.6 ± 10.2 bpm vs. +2.1 ± 6.8 bpm; $p<0.01$), exercise HR (-8.4 ± 8.7 bpm vs. +0.4 ± 7.3 bpm; $p<0.01$), end of exercise HR (-14.1 ± 10.2 bpm vs. +1.1 ± 9.4 bpm; $p<0.01$), and recovery HR (-11.9 ± 12.8 bpm vs. -0.3 ± 11.4 bpm; $p=0.01$). There was also an increase in estimated VO2 max (+1.9 ± 1.9 ml/kg/min vs. 0.0 ± 1.8 ml/kg/min; $p=0.01$) and a decrease in one mile run time (-1.5 ± 1.0 minutes vs. ± -0.1 ± 0.9 minutes; $p<0.01$). Figure 3 and 4 illustrate pre and post-intervention HR response during the step test. The response among the control group is superimposable pre and post, while the intervention group shows obvious deviation and a lower HR throughout the protocol after the intervention.

Table 15. Pre- and Post-Intervention Fitness and One Mile Run Data Among Intervention and Control Participants[1]

	Intervention (n=14)	Control (n=14)	Difference in Change[2]	Cohen's d	p-value[3]
Baseline HR (beats/min)					
Pre	70.3 ± 6.6	69.9 ± 7.8			
Post	62.6 ± 6.4	71.9 ± 8.6			
Change	-7.6 ± 10.3[4]	2.1 ± 6.8	-9.7 ± 3.3	1.11	0.00
Exercise HR (beats/min)					
Pre	124.3 ± 12.0	126.1 ± 13.8			
Post	115.8 ± 11.6	126.5 ± 11.4			
Change	-8.4 ± 8.7[4]	0.4 ± 7.3	-8.9 ± 3.02	1.1	0.00
End Exercise HR (beats/min)					
Pre	141.9 ± 15.2	142.2 ± 16.8			
Post	127.7 ± 15.8	143.4 ± 15.9			
Change	-14.1 ± 10.2[4]	1.1 ± 9.4	-15.3±3.7	1.55	0.00
Recovery HR (beats/min)					
Pre	113.6 ± 15.8	116.6 ± 15.0			
Post	101.7 ± 15.3	116.3 ± 16.6			
Change	-11.9 ± 12.8[4]	-0.3 ± 11.4	-11.6 ± 4.6	0.95	0.01
Estimated VO2 Max (ml/kg/min)					
Pre	41.9 ± 4.5	42.3 ± 4.2			
Post	43.8 ± 4.4	42.3 ± 4.2			
Change	1.9 ± 1.9[4]	0.0 ± 1.8	-1.9 ± 0.7	1	0.01
One Mile Run (minutes)[d]					
Pre	12.1 ± 2.8	11.9 ± 2.4			
Post	10.5 ± 2.6	11.8 **± 2.0**			
Change	-1.5 ± 1.0[4]	-0.1 ± 0.9	-1.4 ± 0.4	1.47	0.00

[1]Reported as mean ± SD

[2]Intervention – control group change (M ± SE)

[3]Differences in changes in fitness measures were analyzed using an ANCOVA comparing mean differences at post adjusting for age, gender, and baseline value.

[4]Significant ($p<0.05$) within group difference measured with a paired t-test

[5]n=13 intervention; n=11 control

Figure 3. Pre-and-Post-Intervention Heart Rate Response to 3-Minute Step Test among Intervention Participants

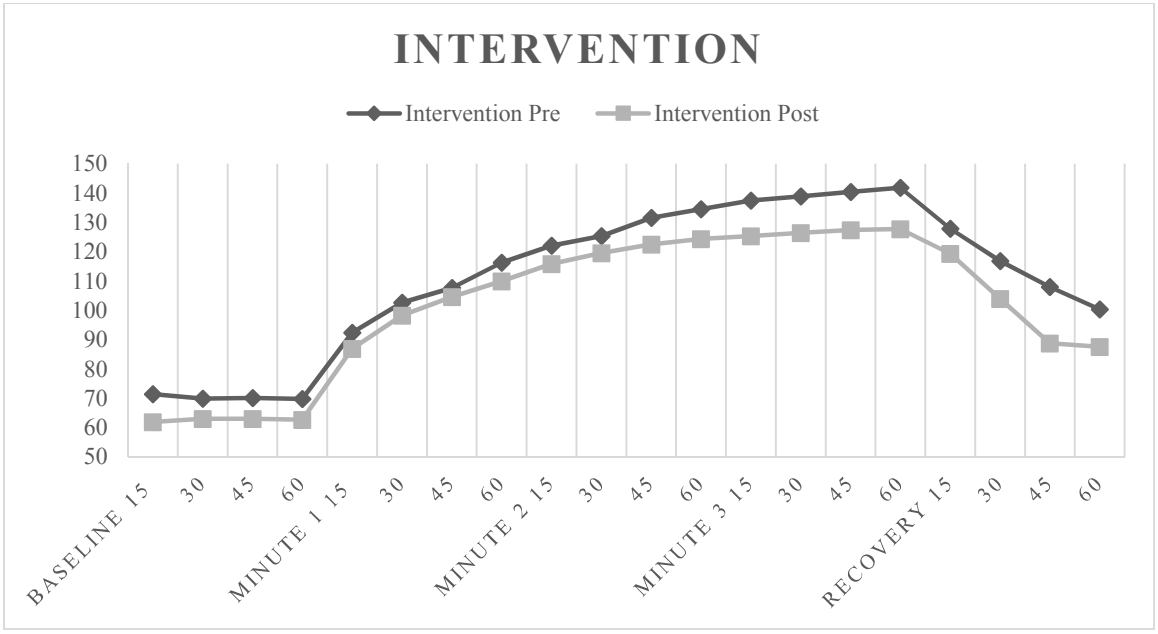
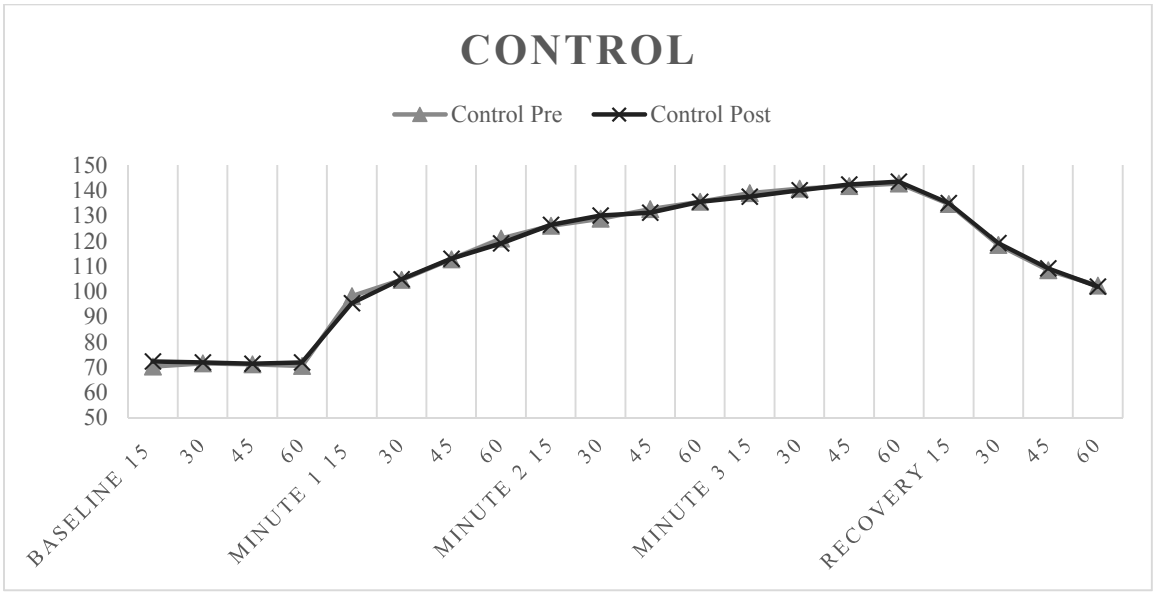


Figure 4. Pre-and-Post-Intervention Heart Rate Response to 3-Minute Step Test among Control Participants



CHAPTER 5

DISCUSSION

The present study examined the efficacy of, AFL, a family-based behavioral intervention, for improving diet and PA habits as well as cardiovascular and metabolic health indicators among Latino parents. Parents who participated in the AFL program significantly improved percent body fat, estimated VO2 max, resting heart rate, and heart rate response to exercise relative to the control group. There were also improvements in self-reported diet and PA variables among intervention participants. However, no differences were observed for diet assessed by 3-day food record, objectively measured PA, and biomarkers for diet or cardiovascular and metabolic disease risk.

Self-Reported Dietary Intake

A primary study outcome was dietary intake, specifically consumption of fruits and vegetables and added sugars, which was assessed by 3-day food record and also through a one-question per item survey. No significant changes were observed among 3-day food record data and effect sizes were small (<0.5), with the exception of pastries for which intervention group participants reported a 0.4 serving/day reduction ($p>0.05$). However, intervention group participants did report a significant increase in vegetable (1.7 servings/day) and fruit consumption (1.5 servings/day) relative to control group participants when answering a single-item behavioral question. These contrasting data are unexpected, however, findings from previous research may offer further insight into the source of these discrepancies.

Two previous family-based interventions with Latino parents have reported improvements in fruits, vegetables or added sugars (152, 154), while three others (124, 125, 150) have reported no changes. The methods of data collection between these studies are quite different. The two studies that reported positive findings also used a single-item assessment. Anderson et al. (152) reported an increase of 0.8 and 0.9 servings/day of fruits and vegetables, respectively, and a 0.6 serving/day reduction in sugar-sweetened beverages using a similar one-item survey as the current study, while Dickin et al. (154) reported a 0.55 and 0.49 point change in reported frequency of intake of fruits and vegetables, respectively, and a 0.37 point reduction in reported soda consumption using one-item questions that were answered on a 5-point Likert scale. One the other hand studies that used a more thorough assessment of diet reported null findings. In two separate studies, Fitzgibbon et al. (125, 150) used a 24 hour food recall and reported no significant changes in consumption of food group servings or nutrients and Klohe-Lehman et al. (124) used a food frequency questionnaire and also reported no significant changes in consumption of food group servings.

These patterns may be the result of a tendency for one-item questionnaires to produce type 1 errors, or on the contrary, for recalls and food frequency questionnaires to produce type 2 errors. There is previous evidence to suggest that the food records and recalls may be less susceptible to social desirability bias than specific behavioral questions (173). Thus, it is not unlikely that participants in the current study over-reported consumption of fruits and vegetables at follow-up when responding to the survey questions. If this is the case, the findings would suggest that participants did not modify dietary consumption in response to the AFL intervention. Furthermore,

intervention group participants reported high consumption of fruits and vegetables at baseline in the 3-day food record (5.3 servings). This is higher than survey reported (2.6 servings) intake among this group at baseline. Although there is a possibility that participants in the intervention group were already consuming an adequate amount of fruits and vegetables, the possibility cannot be ruled out that this high reported intake was a result of recall bias.

Although several behavioral strategies were employed to encourage dietary change, there are several possible explanations for the lack of significant dietary changes in the current study. First, dietary change is complex and rooted in cultural values and is influenced by social pressure, and time and financial constraints (174). Modifications of these factors, or perceptions of these factors is beyond the scope of the AFL intervention. An important predictor of dietary change is stage of change as outlined by the Trans-theoretical Model (175). Although not assessed, individuals in the current study were likely spread through various stages of dietary change, and individuals who were in earlier stages of change (i.e. pre-contemplation or contemplation) may have been more resistant to change. Nevertheless, it is not clear if participants did not in fact improve diet consumption in response to the intervention. At present all dietary self-report measures have several limitations and it is impossible to determine the true dietary intake without direct observation or feeding (173).

Nutritional Biomarkers

Nutritional biomarkers can be a useful, objective method for assessing intake of specific foods or food groups. In the current study, concentrations of carotenoids and

TAC in plasma were measured as additional indirect indicators of fruit and vegetable intake. TAC can be measured in blood as a biomarker of antioxidant status and protection against oxidative stress (176). Oxidative stress refers to the proliferation of free radicals beyond what can be eliminated or neutralized by protective antioxidants (177). Oxidative stress is implicated in the development of most of the common chronic diseases including heart disease, cancer, type 2 diabetes, and neurodegenerative diseases (177-179). TAC is influenced by dietary quality, specifically high consumption of antioxidant-containing foods such as fruits and vegetables (176, 180).

In the present study, no changes in TAC concentration between the intervention and the control group were observed and both groups had lower TAC at post-intervention. In a previous study, Cao et al. (181) reported increases in total antioxidant capacity after 6 days among participants who were provided a diet consisting of 10 servings of anti-oxidant rich fruits and vegetables each day. Although participants in the current study reported high intake of fruits and vegetables, robust changes in high antioxidant fruit and vegetable consumption sufficient to produce changes in TAC were likely not achieved as they would have almost certainly been detected by dietary assessments. TAC actually moved in the opposite direction than what was expected. This could suggest reductions in anti-oxidant rich food consumption among the intervention group, however, it may also be coincidental as non-dietary factors also influence total oxidative load and anti-oxidant capacity (176).

Carotenoids are a class of phytochemicals that are abundant in naturally-colored green, red, yellow, and orange foods, particularly fruits and vegetables (182). Carotenoids are not produced by the body, therefore their presence in blood are a direct result of

consumption of carotenoid-rich foods (182). High blood carotenoid concentrations have been associated with a reduced risk of coronary heart disease, several cancers, and all-cause mortality (183-186). In the current study concentrations of lutein, lycopene, beta-cryptoxanthin, and beta-carotene were assessed. Primary sources of lutein are foods that are yellow to orange colored including cantaloupe, corn, yellow/orange bell peppers, and eggs (187). Lycopene sources include tomatoes and other fruits and vegetables with red pigmentation (188). Primary sources of beta-cryptoxanthin include citrus fruits, and primary source of beta-carotene include orange colored fruits and vegetables including cantaloupe, carrots, and pumpkin (189, 190). Despite the lack of statistical significance, a small to moderate effect size towards an increase in total carotenoids, lycopene, and beta-cryptoxanthin was observed among the intervention group, while a small to moderate effect size was observed towards an increase in lutein was observed for the control group.

Unlike TAC, total carotenoids, lycopene, and beta-cryptoxanthin changed in the expected direction. However, it is not surprising that these changes did not reach statistical significance. Watzl et al. (191) reported a significant increase in carotenoid concentrations among 64 men who increased carotenoid rich fruit and vegetable consumption from 2 servings/day to either 5 or 8 servings/day for 4 weeks compared to a third group that continued consuming 2 servings/day. These data suggest that, with a larger sample, a change of 3 servings/day in fruits and vegetables would be sufficient to produce significant changes in dietary carotenoids. The sample in the current study was significantly smaller and according to both methods of dietary assessment, participants did not modify dietary consumption to the degree necessary to elicit significant changes in plasma carotenoids.

Adiposity

Contrary to previous studies examining the effect of family-based studies with Latino parents (65, 124, 149, 153, 155), participants in the current intervention did not experience significant weight or BMI changes relative to the control group. The AFL intervention was designed as a health promotion program and emphasis was placed in improving diet quality and increasing PA, without strong emphasis on caloric restriction and weight reduction. Therefore, it is not surprising that significant weight loss was not observed among the intervention group relative to the control group. However, within-group analysis revealed that a significant within group change in weight was observed among the intervention group (-1.1 kg).

Parents in the intervention group did, however, achieve a significantly greater reduction in percent body fat (-1.1% vs. + 0.2%) and there was a trend towards a reduction in visceral fat mass (-6% vs. 0%) relative to the control group. The 1.1% reduction in body fat among the intervention group is notable, as it translates to a 1.4 kg fat loss and a 0.3 kg gain in non-fat mass, which together constitute the net 1.1 kg loss in total body mass. This novel finding is of importance because data examining the effects of family-based lifestyle interventions with Latino parents on body fat and body fat distribution is not available in the existing literature. There is evidence, however, for improving percent body fat among a community based Latino sample. Ruggiero et al. (192) reported significant reductions in percent body fat (-1.2%) and body weight (-2.2 kg) among 69 overweight Latino adults who participated in a modified version of the DPP. This study is quite different from the current study as it was targeted towards individuals, not families, there was no control group, and primary goal of the study was

weight loss (192). No other studies were identified that reported body fat changes in response to lifestyle intervention among Latinos.

Evidence has shown that percent body fat may be a more sensitive measure than body weight or BMI for detecting impairments in glucose metabolism, a key component of metabolic disease (193). A growing and convincing body of research has suggested that body fat distribution may be a more specific marker of cardiovascular and metabolic disease risk than total body mass or percent body fat. Specifically, visceral fat has demonstrated an independent and inverse relationship with cardiovascular and metabolic health indicators (194, 195). Visceral fat has direct access to the portal vein and has high free fatty acid turnover. This results in a high spillover of free fatty acids into the liver from the visceral fat compartment, which is thought to be responsible for the direct effect of visceral fat on metabolism and chronic disease risk (195).

In the present study, participants in the intervention group experienced a 6% reduction in visceral fat. Two studies have assessed visceral fat in response to a lifestyle intervention (196, 197). Goodpaster et al. (197) reported a 29% reduction in visceral adipose tissue among 67 obese adults after 6 months of an intensive lifestyle intervention that consisted of 3 group meetings and one individual contact per month. Participants were prescribed a calorically restricted diet and PA and were asked to monitor their habits to assess adherence. In addition to the reduction in visceral fat, participants experienced an 11 kg weight loss and a 9% reduction in body fat. Borel et al., (196) reported a 26% reduction in visceral fat among 117 abdominally obese men who participated in a 12-month lifestyle intervention consisting of individual bi-weekly counseling for 4 months, followed by monthly counseling thereafter. Each session

included a meeting with a registered dietitian to achieve a 500 kcal/day energy deficit, followed by a meeting with a kinesiologist who prescribed a PA program to achieve 150 min/week of MVPA. Participants lost 6.5 kg and 4.2 % of body fat. Interestingly, changes in visceral adipose tissue was strongly associated (R^2=0.58) with changes in cardiovascular fitness. These studies were quite different than the current study, as both prescribed a calorically restricted diet and a PA program, both recruited participants based on an adiposity criteria, neither included the family in the intervention, and neither recruited a majority Latino sample. Despite these differences these studies are among the few that have assessed visceral fat in response to lifestyle intervention and they offer insight into the utility of personalized counseling for achieving reductions in visceral adiposity and total weight loss.

Cardiometabolic Disease Biomarkers

Traditional measures of cardiovascular and metabolic disease including fasting blood pressure, lipids, glucose, and insulin were also measured in the current study. These measures are directly related to the development of type 2 diabetes and diseases of the heart and can be modified by diet and physical activity changes independent of weight reduction (198). Thus, they are important markers to assess when evaluating programs intended for the prevention of future chronic disease. Findings from the current study demonstrate no significant changes in any of these measures in intervention participants relative to their control counterparts, and effect sizes ranged from d=0.09 (insulin) to d=0.38 (triglycerides).

The lack of improvement in these outcomes may be due to the participants' relative health status at the start of the program. Only 6 (21%) participants met the clinical criteria for metabolic syndrome at baseline, despite the high level of obesity (57%). This might be attributed to the age of participants as this was a relatively young sample and national estimates show that Latino women age 20-39 have only a 20% rate of metabolic syndrome (9). This figure rises to 50% among Latino women age 40-59, highlighting the need for early prevention (9). Although changes were not statistically significant, it is important to consider the directionality of the changes observed. In the current study each of the cardiovascular risk factors assessed moved in favor of the intervention group.

Two previous studies have demonstrated improvements in cardiovascular risk factors among Latino adults participating in a family-based lifestyle intervention (40, 155). Nader et al. (40) observed a reduction in systolic and diastolic blood pressure among Latino parents of 5th and 6th grade children who participated in a year-long behavioral intervention. In this study participants had similar baseline blood pressure to participants in the current study. Possible explanations for these findings are the sample size and focus of the study. In the study by Nader et al., the sample size was significantly larger than the current study (99 vs. 28). Additionally, Nader et al. (40) focused on reducing salt intake as a key focus of the dietary component of the intervention and participants reported reducing their salt intake in response to the intervention. High salt consumption leads to fluid accumulation and an increase in peripheral vascular resistance and blood pressure, and focusing on dietary salt reduction can have a sizeable blood pressure reducing effect (199). The AFL program did not place a strong emphasis on

dietary salt reduction, which may explain the lack of significant effect on blood pressure in the current study.

Ziebarth et al. (155) also reported improvements in blood pressure as well as fasting glucose among a group of parents of school aged children who completed the 8-week *We Can!* exercise and nutrition education curriculum. Participants started the study with a high fasting glucose concentration (97 mg/dL) which may explain the significant changes in this variable. However, the blood pressure data is surprising as participants had low blood pressure at the start of the study (108/68 mm Hg) (155). In the current study glucose values were low at the start of the program (83 mg/dL) and dropped by 2.5 mg/dL in response to the intervention. The low baseline values left little room for improvement and the small sample size also limited the potential for statistically significant findings. Interestingly, blood pressure was reduced in the study by Ziebarth et al. (155) despite low baseline value. The authors did not report emphasizing salt reduction and participants did not achieve dramatic weight loss (-0.9 kg; $p<0.01$) which make it further difficult to explain these findings. It is possible that general diet and PA changes occurred among participants in this study to produce these effects, however PA and diet data were either not collected or not published. A unique aspect of this program that the authors discussed that may have contributed to success of this study were environmental changes including a walking group and family exercise night organized by intervention participants and changes in a local restaurant's menu to include healthier items. Although this program reported positive findings, the short program length (8 weeks) and the lack of follow-up are limitations. No other studies reported on biochemical outcomes among Latino parents who participate in lifestyle intervention.

Physical Activity

No significant changes in accelerometer-measured PA were observed between groups. This is in contrast to survey-assessed PA in which participants reported increasing the number of days per week that they perceived achieving at least 30 minutes of MVPA. It is possible that these are both accurate assessments of participants' physical activity as each measure assessed a different time period. Participants wore accelerometers after the termination of the program, while the survey assessed physical activity during the last week of the intervention. If these data are accurate, it would suggest that intervention participants increased their PA during the intervention and returned to a baseline level immediately, thereafter. However, it is also possible that parents in the intervention group reported high levels of physical activity as a result of social desirability bias similar to the one-item diet survey questions on diet. It is also possible that participants overestimated MVPA due to misperceptions of the definitions of MVPA. The survey defined MVPA and gave several examples of what types of activities would fall under this category, however, there is still room for misinterpretation.

There is anecdotal evidence to suggest that participants partook in more PA during the intervention period. As a part of the behavioral program parents were encouraged to connect with one another outside of the intervention to engage in physical activities. Many participants interacted through a Facebook page and organized weekend hikes that were several hours in length. Based on information from Facebook posts, there were a core group of participants (approximately 4) who attended regularly and others

who attended sporadically (approximately 4). Attendance at one of these hikes would provide enough MVPA to far exceed PA recommendations (83, 200).

This study is one of only three studies that reported an objective measure of physical activity for Latino parents participating in a family-based lifestyle intervention. Fitzgibbon et al., (125) also collected accelerometer data and reported no differences in MVPA between a control and intervention group in response to the intervention. On the other hand, Klohe-Lehman et al., (124) reported a significant increase in pedometer steps per day among intervention group participants relative to control. The increase reported in this study was quite substantial, 3,845 steps/day, which translates to almost two more miles of steps per day. Unlike accelerometers, pedometers provide feedback about PA which may serve to motivate participants to increase PA. Previous research has consistently shown that wearing a pedometer leads to increased PA (201). Therefore, although the findings achieved by Klohe-Lehman et al. (124) are notable, the data is not comparable to accelerometer data. To date no studies have reported increased accelerometer measured physical activity among parents in response to family-based lifestyle intervention.

Fitness

Cardiovascular fitness is an independent predictor of type 2 diabetes risk, and cardiovascular disease and mortality (202, 203). The AFL intervention significantly improved measures of fitness as indicated by 11%, 7%, and 10% lower resting HR, HR response to exercise, recovery HR, respectively, and a 5% higher estimated VO2 peak. This is in contrast to two similar studies conducted by Olvera et al. (148) and Nader et al.

(40) who reported no fitness changes among parents who participated in family-based behavioral interventions (40, 148). The lack of significant improvement reported in the study by Olvera et al. (148) is surprising as intervention group participants exercised three times a week as opposed to two in the current study. However, Olvera et al. reported low-to-moderate intensity exercise sessions, whereas in the current study exercise intensity was progressively increased with the intention of achieving a moderate-to-high exercise intensity towards the end of the 12 week program. On the other hand, Nader et al. (40) also reported a similar increase towards more vigorous physical activity as the intervention progressed, however, the lower frequency (1x week for 3 months and monthly thereafter) may have limited the potential for fitness improvements.

Although the present study did not directly measure cardiovascular fitness, the heart rate changes observed are indicative of a positive physiological response to exercise training (204). Participants in the intervention group demonstrated a reduced resting, exercise, and post-intervention heart rate which are likely the result of increased coronary stroke volume, a key determine in maximal aerobic capacity (204).

Previous studies with Latina women have also demonstrated improvements in fitness (119, 205). Hovell et al. (119) randomized 151 Latinas to a 6 month exercise intervention that consisted of three 90 minute group sessions per week (60 minutes of active exercise + 30 minutes of education) held at a community setting, or a control group. Based on a VO2 max test, intervention group participants increased maximal oxygen uptake by 17% relative to a 3% increase in controls ($p<0.001$). Ayala et al. (205) assessed fitness in a quasi-experimental study using distance walked during a 6-minute walk test in response to an intervention delivered to 337 Latino women. The intervention

employed 30 promotoras to encourage PA by delivering print materials that provided information about PA opportunities in the community, offering free exercise classes, and providing exercise equipment (e.g. pedometers, exercise bands). Fitness was improved at 6 months and 1 year after the intervention. Taken together these findings suggest that fitness levels can be improved among Latino samples through the use of supervised exercise and behavioral strategies to support PA outside of the exercise sessions.

Parents who participated in AFL improved their one mile run time by 12%, while no change was observed in the control group. Avila and Hovell (206) also observed a reduction in 1-mile run time among Latinas randomized to a lifestyle intervention consisting of 8 one hour sessions that taught behavior change strategies, delivered nutrition education, and had participants stretch and walk (206). Participants increased their speed by 55% from baseline to post-intervention, while speed among the control group did not change. A comparison to the current study is difficult as the authors reported speed (mile/minute) rather than total time to complete the walk. A conversion reveals that participants completed the mile in 20 minutes at baseline, and improved to 13.2 minutes at post-intervention (206). In contrast, participants in the current study completed the mile in 12 minutes at baseline and improved to under 11 minutes post-intervention. These differences in run times may be the result of differential effort, sample characteristics, or the instructions given to participants. In the current study participants were asked to complete the mile in as little time as possible at both time points, and observationally most of the participants made an effort to do so. The relatively low one mile run time at baseline increases confidence that the improvements that were observed were a result of improved performance and not differences in effort

from baseline to post-intervention. The findings reported by Avila and Hovell may have been partially due to improvements in performance, but also likely included differences in effort, as a 55% improvement in speed is not likely given nature of the intervention. These studies offer evidence for improving performance among Latino adults in response to lifestyle intervention.

It is impossible to determine what factors produced the changes in fitness and performance that were observed among intervention group participants in the current study, however, it is unlikely that exercise during the intervention alone could have led to the improvements observed among the intervention group. Exercise achieved during the program was far below the national PA guidelines (83) and accelerometer data suggest that intervention group participants were not sedentary at baseline (37.4 min/day of MVPA) and did not increase their physical activity in response to the intervention. It is probable that a combination of PA during and outside of sessions combined to produce the necessary stimulus for adaptation.

Retention and Participation

One of the primary challenges in working with underserved Latino families is the high attrition and low intervention attendance rates (125, 152). In the current study retention was 85% which is higher than most family-based interventions that target Latino parents (65, 124, 152, 153). Parents attended an average of 17.7 ± 5.0 (74%) AFL sessions and 71% of the participants (n=10) attended at least 16 of 24 (66%) sessions.

Several factors may have contributed to the success in retaining and engaging participants. First, the program was delivered in a centrally located community center in

South Phoenix and recruitment efforts were focused towards the surrounding community. Consequently, the majority of participants lived within a five-mile radius of the intervention site which may have lessened potential transportation barriers. Moreover, consistent with operant conditioning strategies, an attendance point tracker was utilized to reinforce program participation. Families were given a sticker for each session that they attended. Stickers were worth five points and the three families with highest number of accumulated points throughout the intervention received recognition and an Amazon gift card at the Olympics ceremony. Surprisingly, these stickers appeared to be a major source of motivation, as parents frequently checked their point totals and made efforts to ensure that they received their sticker at each session.

Another possible factor that may have contributed to the high retention and attendance rates is the personal relationships that developed between the program staff and the participants. *Confianza*, a Latino cultural construct that refers to trust and intimacy within a relationship, is important for engaging Latinos in health services (207). The AFL program was delivered in an interactive manner, which allowed the families to develop personal connections with one another as well as with the program staff. Program staff also called participants when they missed intervention sessions to express concern regarding their future attendance. Each of these factors likely contributed to high retention and attendance rates indicating strong feasibility and acceptability of the AFL program among underserved families of South Phoenix.

Strengths

There are several strengths and limitations of the present study that warrant further discussion. A primary strength of this study was the study design, specifically the experimental design and the strength of the measures used. Many studies that have implemented family behavioral interventions with Latino parents have used a quasi-experimental approach, which has compromised the internal validity of the findings (124, 152-155). Further, measures are often limited to self-reported behaviors (150, 154) weight (65, 151, 153) or both (149, 152). Few studies have used objective behavioral measures (124, 125) or indicators of cardiometabolic disease risk (40, 148, 155). There are several limitations with collecting self-reported diet and activity data (208, 209) and, although weight can be a useful marker of cardiometabolic disease risk, exercise and diet can improve disease risk independent of weight loss (198). In the current study a combination of self-report and objectively assessed measures were used to assess behaviors, and weight and body composition changes were assessed in addition to several additional risk factors for cardiometabolic disease. Only one other study in this area used a similar battery of measures (40).

The community-academic partnership which enabled the program to be delivered at a low-cost at a convenient location in an underserved area of Phoenix is another strength of this study. Existing resources of each partner were leveraged to deliver AFL. The community partners provided space, equipment, advice, feedback, and recruitment support that were essential to the delivery of AFL. Institutional involvement provided technical knowledge and skills to carry out the study and enabled the implementation of a training program to recruit student volunteers to carry out most of the study activities.

A final strength of this study is the iterative nature of program development that has led to the intervention as it is currently implemented. A literature review, two focus groups, a low resource feasibility and acceptability study, and an intensive proof of concept study contributed to the formation of the AFL intervention (unpublished observations). Feedback from participants was solicited at each phase of program delivery to tailor the program to the specific needs of the target population and continue to optimize active intervention components.

Limitations

The limitations of this study are also vital to proper interpretation of the findings. Several factors associated with diet data collection limit the validity of available dietary intake data. Six (4 intervention, 2 control) participants did not return a 3-day food record at baseline or post-intervention limiting the final sample of this measure to 22. Further, several participants had incomplete and unclear records at the time of collection, and some records did not have a full 3 days of collection. Research staff reviewed records and questioned participants to fill in missing data, but accuracy of the report was likely to be compromised as some of the data had been recorded a week prior. An interviewer administered 24-hour recall may have produced more accurate findings, however, this was not possible given staff limitations. We collected additional diet data by survey using a simple one question format for each variable of interest. This is assessment of diet has not been validated, therefore, these data must be interpreted with caution. Unfortunately, no strong, validated, objective measures of diet intake exist, therefore, limitations with the collection of diet data cannot be overcome (210).

There are also limitations with the PA and fitness data. Using accelerometers to objectively collect PA data provides a strong assessment of PA. However, in the current study, this method of data collection proved to be a limitation as a result of compliance issues. Valid baseline and post-intervention data were only collected for 16 participants (10 intervention, 6 control) and these participants may not reflect the full sample. Reminder calls were made to participants throughout the week of data collection in order to minimize compliance issues, but this was not sufficient to produce desired compliance rates. PA was also assessed with one survey item. Participants were asked to estimate their MVPA over the past week with this item. An explanation of MVPA was given along with examples of activities that would be classified in this category. However, there may have been misinterpretation of activities that constitute MVPA as this data did not reflect accelerometer data. This method of PA assessment is also not validated and, therefore, the findings must be interpreted with caution.

There are also limitations to assessing fitness using the 3-minute step test as it is not a true measure of oxygen uptake. Further, the significant reductions observed in resting and exercise HR could have been attributed to higher levels of comfort with program staff rather than a true training effect. However, given the study design, it would be difficult to conduct a VO2 max test on participants in this study and measuring heart rate response to the 3 minute step test allowed for a low-cost field measure of a physiological response to exercise to be conducted.

Another important limitation is the inclusion of families who were involved in previous pilot phases of the study. Twelve of the 28 (43%) participants who completed this study were involved in pilot phases of the AFL program. This could have

compromised the power of the study, as these participants may have experienced improvements in study outcomes prior to this phase leaving less room for further improvement at the inception of this phase. This also introduces a bias towards improved attendance and participation and possibly greater motivation to make behavioral changes. However, past participants were equally randomized to the intervention and control groups which helped to control this confounding factor.

Selection bias among parents who chose to enroll their family in a lifestyle intervention is another important limitation. It is likely that participants who choose to enroll in a family based lifestyle intervention program are not representative of the general population and may be more inclined to make diet and physical activity changes than those who choose not to enroll in the study. This limitation makes it difficult to determine the impact dissemination of this program would have on a larger group, as there may not be many additional families who would benefit from this program who did not choose to sign-up.

Another limitation is the number of variables that were analyzed. Statistical tests were conducted on fifty-two separate variables, which greatly increases the probability of a type 1 error without proper adjustment of p-value. A reason for the inclusion of this many variables is the nature of the study. This study provided the infrastructure to conduct a number of additional exploratory assessments which allowed for the presentation of a more complete picture of behavioral and physiological changes that may have occurred in response to the intervention. Also, there is limited information regarding the effects of community-based interventions for many of the variables included herein,

so it would have been difficult to pinpoint variables that would be most likely to be affected by the intervention.

Another limitation of this study was the relatively small sample size. The study was insufficiently powered to detect changes without quite large effect sizes ($d<0.7$), therefore many null findings reported herein may be the result of lack of power rather than lack of effect on the measure. Several of the outcomes demonstrated moderate effect sizes (>0.5), however, statistical significance was not achieved. Fortunately, the present study was a preliminary efficacy report on the AFL study that has a final sample size goal of 120. By the final enrollment of this study adequate power to examine the efficacy of the AFL program for improving cardiovascular and metabolic disease will be possible.

A final limitation is the use of student volunteers to assist with conducting all aspects of the study. There is a high turnover rate with student volunteers as students graduate, or take on additional responsibilities that interfere with their continued participation in the project. As a result many students have limited opportunity to gain substantial experience with conducting measures and delivering the program. Employing experienced program staff would likely improve data collection and intervention delivery, however, the cost of the intervention would increase dramatically and the program may not be sustainable as a result. This is a challenge that is best addressed with strong training and supervision of student volunteers and strong efforts to retain students across semesters and academic years.

Implications and Future Research

The findings of this study add to a small but growing body of literature that examines the impact family-based behavioral intervention studies on Latino parents. This is an important field of research as the Latino population is growing rapidly and population trends project an increased proportion of US born Latinos, who exhibit more high risk behavioral patterns than their foreign-born counterparts (7). As a result, there is a growing need for effective prevention efforts and community-and-family-based interventions are an integral part of an aggressive multi-level prevention strategy directed towards Latinos (14).

At present, the majority of family-based intervention studies focus on child outcomes. Involving parents in family-based interventions and failing to collect data to determine the impact of their involvement on their own behaviors and health is a missed opportunity. Improving behavioral and physiological variables has the potential to simultaneously reduce chronic disease risk among parents and also impact children, as evidence has shown that parent behaviors influence child behaviors (132, 133, 139). Interventions that simultaneously focus on parent and child outcomes reinforce parents' responsibility as a role model for healthy behaviors (211). Additionally further exploration regarding the impact of parenting style on child behaviors is warranted. Integrating parenting strategies into family-based interventions may have added benefit (143, 154, 156).

It is also important to focus on improving behavioral targets and cardiometabolic disease risk factors rather than just weight. In the present study improvements in percent body fat and fitness were observed despite an absence of significant between group

changes in weight and BMI. The majority of research in this field places a primary emphasis on weight loss despite very low long-term weight loss success rates and mounting data of the benefits of adequate diet and PA behaviors independent of weight loss (198). The current study suggest that improvements in fitness in response to family-based intervention may be a primary target for intervention.

The strong effect of the AFL intervention on HR response to exercise is a novel finding. At present few studies have targeted fitness improvements among Latino families and the findings of the current study suggest that a fitness-centered approach may be warranted. Improving fitness and performance may have additional benefits beyond their impact on health as improving fitness may improve exercise self-efficacy and could further improve the potential for long-term behavioral maintenance. A re-designed program with fitness as a primary emphasis using gas exchange to assess this variable is the next logical step in response to the current findings. Although the null findings of this study with regard to biomarkers for cardiovascular and metabolic disease are discouraging, this is likely the result of the sample characteristics at baseline. Targeting a sample that is most likely to improve these factors (e.g.hypercholesterolemic, pre-diabetic) may produce significant improvements among these variables, however, this was not the focus of the current study as it was designed as a public health prevention program rather than a treatment program. Future interventions that aim to improve these variables should target higher risk Latino parents and their children.

Conclusion

The AFL program demonstrated promising preliminary success for improving body composition and fitness among parents of elementary-age children who were mostly Latina women. On the other hand, no improvements in risk factors for cardiometabolic disease were demonstrated and the impact of the AFL program on diet and PA behaviors is mixed. Future programs targeting Latinos examining the impact of community-and-family-based interventions as a preventative approach to public health are warranted. Results of the current study suggest that future research may benefit from targeting fitness as a primary outcome. Further, interventions that aim to improve risk factors for cardiovascular and metabolic disease should explore the impact of nutrition and PA programs on groups with high baseline risk. Successful implementation of these programs could have a substantial impact on chronic disease risk among Latino populations and could help to eliminate disparities in obesity and type 2 diabetes that currently exist.

REFERENCES

1. Anonymous U.S. Census Bureau, 2009-2013 5-Year American Community Survey. Version current 2013. Internet: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF (accessed 01/07 2015).

2. Organization for Economic Cooperation and Development (OECD) Staff. Health at a Glance 2013: OECD Indicators. OECD, 2013.

3. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. JAMA 2014; 311:806-14.

4. Tsai AG, Williamson DF, Glick HA. Direct medical cost of overweight and obesity in the USA: a quantitative systematic review. Obesity Reviews 2011; 12:50-61.

5. Wang YC, McPherson K, Marsh T, Gortmaker SL, Brown M. Health and economic burden of the projected obesity trends in the USA and the UK. The Lancet 2011; 378:815-25.

6. Olshansky SJ, Passaro DJ, Hershow RC, Layden J, Carnes BA, Brody J, Hayflick L, Butler RN, Allison DB, Ludwig DS. A potential decline in life expectancy in the United States in the 21st century. N Engl J Med 2005;352:1138-45.

7. Perez-Escamilla R. Acculturation, nutrition, and health disparities in Latinos. Am J Clin Nutr 2011;93:1163S-7S.

8. Vega WA, Rodriguez MA, Gruskin E. Health disparities in the Latino population. Epidemiol Rev 2009;31:99-112.

9. Mozumdar A, Liguori G. Persistent increase of prevalence of metabolic syndrome among U.S. adults: NHANES III to NHANES 1999-2006. Diabetes Care 2011;34:216-9.

10. Centers for Disease Control and Prevention. National diabetes statistics report: estimates of diabetes and its burden in the United States, 2014. Atlanta, GA: US Department of Health and Human Services 2014.

11. Cowie CC, Rust KF, Ford ES, Eberhardt MS, Byrd-Holt DD, Li C, Williams DE, Gregg EW, Bainbridge KE, Saydah SH, et al. Full accounting of diabetes and pre-diabetes in the U.S. population in 1988-1994 and 2005-2006. Diabetes Care 2009;32:287-94.

12. Writing Group for the SEARCH for Diabetes in Youth Study Group, Dabelea D, Bell RA, D'Agostino RB,Jr, Imperatore G, Johansen JM, Linder B, Liu LL, Loots B,

Marcovina S, et al. Incidence of diabetes in youth in the United States. JAMA 2007;297:2716-24.

13. Passel JS, Cohn D. US population projections: 2005-2050. 2008.

14. US Department of Health and Human Services. HHS action plan to reduce racial and ethnic health disparities: A nation free of disparities in health and health care. Washington, DC: US Department of Health and Human Services 2011.

15. de Koning L, Malik VS, Kellogg MD, Rimm EB, Willett WC, Hu FB. Sweetened beverage consumption, incident coronary heart disease, and biomarkers of risk in men. Circulation 2012;125:1735,41, S1.

16. Carter P, Gray LJ, Troughton J, Khunti K, Davies MJ. Fruit and vegetable intake and incidence of type 2 diabetes mellitus: systematic review and meta-analysis. BMJ 2010;341:c4229.

17. Yang Q, Zhang Z, Gregg EW, Flanders WD, Merritt R, Hu FB. Added sugar intake and cardiovascular diseases mortality among US adults. JAMA internal medicine 2014;174:516-24.

18. Johnson RK, Appel LJ, Brands M, Howard BV, Lefevre M, Lustig RH, Sacks F, Steffen LM, Wylie-Rosett J. Dietary sugars intake and cardiovascular health a scientific statement from the american heart association. Circulation 2009;120:1011-20.

19. Sui X, Hooker SP, Lee IM, Church TS, Colabianchi N, Lee CD, Blair SN. A prospective study of cardiorespiratory fitness and risk of type 2 diabetes in women. Diabetes Care 2008;31:550-5.

20. Rana JS, Li TY, Manson JE, Hu FB. Adiposity compared with physical inactivity and risk of type 2 diabetes in women. Diabetes Care 2007;30:53-8.

21. Sesso HD. Physical activity and coronary heart disease in men: The Harvard Alumni Health Study. Circulation (New York, N.Y.) 2000;102:975.

22. Sieverdes JC, Sui X, Lee DC, Church TS, McClain A, Hand GA, Blair SN. Physical activity, cardiorespiratory fitness and the incidence of type 2 diabetes in a prospective study of men. Br J Sports Med 2010;44:238-44.

23. Marquez DX, Neighbors CJ, Bustamante EE. Leisure time and occupational physical activity among racial or ethnic minorities. Med Sci Sports Exerc 2010;42:1086-93.
24. Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. Med Sci Sports Exerc 2008;40:181.

25. Kimmons J, Gillespie C, Seymour J, Serdula M, Blanck HM. Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. Medscape J Med 2009;11:26.

26. Thompson FE, McNeel TS, Dowling EC, Midthune D, Morrissette M, Zeruto CA. Interrelationships of added sugars intake, socioeconomic status, and race/ethnicity in adults in the United States: National Health Interview Survey, 2005. J Am Diet Assoc 2009;109:1376-83.

27. Caballero AE. Diabetes in the Hispanic or Latino population: genes, environment, culture, and more. Current diabetes reports 2005;5:217-25.

28. Artinian NT, Fletcher GF, Mozaffarian D, Kris-Etherton P, Van Horn L, Lichtenstein AH, Kumanyika S, Kraus WE, Fleg JL, Redeker NS. Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk factor reduction in adults a scientific statement from the American Heart Association. Circulation 2010;122:406-41.

29. Dunkley A, Charles K, Gray L, Camosso-Stefinovic J, Davies M, Khunti K. Effectiveness of interventions for reducing diabetes and cardiovascular disease risk in people with metabolic syndrome: systematic review and mixed treatment comparison meta-analysis. Diabetes, Obesity and Metabolism 2012;14:616-25.

30. Pearson TA, Palaniappan LP, Artinian NT, Carnethon MR, Criqui MH, Daniels SR, Fonarow GC, Fortmann SP, Franklin BA, Galloway JM, et al. American Heart Association Guide for Improving Cardiovascular Health at the Community Level, 2013 update: a scientific statement for public health practitioners, healthcare providers, and health policy makers. Circulation 2013;127:1730-53.

31. Orchard MD. Impact of intensive lifestyle and metformin therapy on cardiovascular disease risk factors in the diabetes prevention program. Diabetes Care 2005;28:888.

32. Brug J, Oenema A, Ferreira I. Theory, evidence and Intervention Mapping to improve behavior nutrition and physical activity interventions. Int J Behav Nutr Phys Act 2005;2:2.

33. Michie S, Ashford S, Sniehotta FF, Dombrowski SU, Bishop A, French DP. A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: the CALO-RE taxonomy. Psychol Health 2011;26:1479-98.
34. Michie S, Abraham C, Whittington C, McAteer J, Gupta S. Effective techniques in healthy eating and physical activity interventions: a meta-regression. Health Psychology 2009;28:690.

35. Kumanyika SK, Grier S. Targeting interventions for ethnic minority and low-income populations. The Future of Children 2006;16:187-207.

36. Elder JP, Ayala GX, Parra-Medina D, Talavera GA. Health communication in the Latino community: issues and approaches. Annu Rev Public Health 2009;30:227-51.

37. Diaz V, Mainous A, Pope C. Cultural conflicts in the weight loss experience of overweight Latinos. Int J Obes 2006;31:328-33.

38. Fitzgerald N, Spaccarotella K. Barriers to a healthy lifestyle: from individuals to public policy-an ecological perspective. Journal of extension 2009;47.

39. Davila YR, Reifsnider E, Pecina I. Familismo: influence on Hispanic health behaviors. Applied Nursing Research 2011;24:e67-72.

40. Nader PR, Sallis JF, Patterson TL, Abramson IS, Rupp JW, Senn KL, Atkins CJ, Roppe BE, Morris JA, Wallace JP. A family approach to cardiovascular risk reduction: results from the San Diego Family Health Project. Health Educ Q 1989.

41. Barkin SL, Gesell SB, Po'e EK, Escarfuller J, Tempesti T. Culturally tailored, family-centered, behavioral obesity intervention for Latino-American preschool-aged children. Pediatrics 2012;130:445-56.

42. West F, Sanders MR, Cleghorn GJ, Davies PS. Randomised clinical trial of a family-based lifestyle intervention for childhood obesity involving parents as the exclusive agents of change. Behav Res Ther 2010;48:1170-9.

43. Faith MS, Van Horn L, Appel LJ, Burke LE, Carson JAS, Franch HA, Jakicic JM, Kral TV, Odoms-Young A, Wansink B. Evaluating Parents and Adult Caregivers as "Agents of Change" for Treating Obese Children: Evidence for Parent Behavior Change Strategies and Research Gaps A Scientific Statement From the American Heart Association. Circulation 2012;125:1186-207.

44. Oude Luttikhuis H, Baur L, Jansen H, Shrewsbury VA, O'Malley C, Stolk RP, Summerbell CD. Interventions for treating obesity in children. Cochrane Database Syst Rev 2009;1.

45. Monzavi R, Dreimane D, Geffner ME, Braun S, Conrad B, Klier M, Kaufman FR. Improvement in risk factors for metabolic syndrome and insulin resistance in overweight youth who are treated with lifestyle intervention. Pediatrics 2006;117:e1111-8.

46. Dreimane D, Safani D, MacKenzie M, Halvorson M, Braun S, Conrad B, Kaufman F. Feasibility of a hospital-based, family-centered intervention to reduce weight gain in overweight children and adolescents. Diabetes Res Clin Pract 2007;75:159-68.

47. Golan M, Kaufman V, Shahar DR. Childhood obesity treatment: targeting parents exclusively v. parents and children. Br J Nutr 2006;95:1008-15.

48. Sallis JF, Nader PR, Broyles SL, Berry CC, Elder JP, McKenzie TL, Nelson JA. Correlates of physical activity at home in Mexican-American and Anglo-American preschool children. Health Psychology 1993;12:390.

49. Sallis JF, Alcaraz JE, McKenzie TL, Hovell MF, Kolody B, Nader PR. Parental behavior in relation to physical activity and fitness in 9-year-old children. American Journal of Diseases of Children 1992;146:1383-8.

50. Bandura A. Health promotion by social cognitive means. Health education & behavior 2004;31:143-64.

51. Bandura A. Social foundations of thought and action. Englewood Cliffs, NJ Prentice Hall., 1986.

52. Baranowski T, Hearn MD. Health behavior interventions with families. In: Anonymous Handbook of Health Behavior Research IV. Springer, 1997:303-323.

53. Belone L, Lucero JE, Duran B, Tafoya G, Baker EA, Chan D, Chang C, Greene-Moton E, Kelley MA, Wallerstein N. Community-Based Participatory Research Conceptual Model: Community Partner Consultation and Face Validity. Qual Health Res 2014.

54. Farag YM, Gaballa MR. Diabesity: an overview of a rising epidemic. Nephrol Dial Transplant 2011;26:28-35.

55. Wee CC, Phillips RS, Legedza AT, Davis RB, Soukup JR, Colditz GA, Hamel MB. Health care expenditures associated with overweight and obesity among US adults: importance of age and race. Am J Public Health 2005;95:159-65.

56. American Diabetes Association. Economic costs of diabetes in the U.S. in 2012. Diabetes Care 2013;36:1033-46.
57. Cawley J, Meyerhoefer C. The medical care costs of obesity: an instrumental variables approach. J Health Econ 2012;31:219-30.

58. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, Gordon DJ, Krauss RM, Savage PJ, Smith SC,Jr, et al. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. Circulation 2005;112:2735-52.

59. Schwarz PE, Greaves CJ, Lindström J, Yates T, Davies MJ. Nonpharmacological interventions for the prevention of type 2 diabetes mellitus. Nature Reviews Endocrinology 2012;8:363-73.

60. Diabetes Prevention Program Resea WC. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. The Lancet (British edition) 2009;374:1677-86.

61. Dunkley AJ, Bodicoat DH, Greaves CJ, Russell C, Yates T, Davies MJ, Khunti K. Diabetes prevention in the real world: effectiveness of pragmatic lifestyle interventions for the prevention of type 2 diabetes and of the impact of adherence to guideline recommendations: a systematic review and meta-analysis. Diabetes Care 2014;37:922-33.

62. Golden SD, Earp JA. Social ecological approaches to individuals and their contexts: twenty years of health education & behavior health promotion interventions. Health Educ Behav 2012;39:364-72.

63. Stokols D. Translating social ecological theory into guidelines for community health promotion. American journal of health promotion 1996;10:282-98.

64. Kitzmann KM, Beech BM. Family-based interventions for pediatric obesity: Methodological and conceptual challenges from family psychology. 2011.

65. Cousins JH, Rubovits DS, Dunn JK, Reeves RS, Ramirez AG, Foreyt JP. Family versus individually oriented intervention for weight loss in Mexican American women. Public Health Rep 1992;107:549-55.

66. Ockene IS, Tellez TL, Rosal MC, Reed GW, Mordes J, Merriam PA, Olendzki BC, Handelman G, Nicolosi R, Ma Y. Outcomes of a Latino community-based intervention for the prevention of diabetes: the Lawrence Latino Diabetes Prevention Project. Am J Public Health 2012;102:336-42.

67. Drieling RL, Ma J, Stafford RS. Evaluating clinic and community-based lifestyle interventions for obesity reduction in a low-income Latino neighborhood: Vivamos Activos Fair Oaks Program. BMC Public Health 2011;11:98,2458-11-98.
68. Census 2. Annual Estimates of the Resident Population by Sex, Race, and Hispanic Origin for the United States, States, and Counties: April 1, 2010 to July 1, 2013 Source: U.S. Census Bureau, Population Division.

69. Schwimmer JB, McGreal N, Deutsch R, Finegold MJ, Lavine JE. Influence of gender, race, and ethnicity on suspected fatty liver in obese adolescents. Pediatrics 2005;115:e561-5.

70. Goran MI, Bergman RN, Cruz ML, Watanabe R. Insulin resistance and associated compensatory responses in african-american and Hispanic children. Diabetes Care 2002;25:2184-90.

71. US Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Healthy People 2020.Washington, DC 2012.

72. Kim JY. Novel Biomarkers and Genetic Variants for Type 2 Diabetes in Latinos 2015.

73. Moy E, Dayton E, Clancy CM. Compiling the evidence: the National Healthcare Disparities Reports. Health Aff (Millwood) 2005;24:376-87.

74. Vargas Bustamante A, Fang H, Rizzo JA, Ortega AN. Understanding observed and unobserved health care access and utilization disparities among US Latino adults. Med Care Res Rev 2009;66:561-77.

75. Macartney S, Bishaw A, Fontenot K. Poverty rates for selected detailed race and Hispanic groups by state and place: 2007–2011. US Department of Commerce, United States Census Bureau: Washington, DC, USA 2013.

76. Hunt KJ, Resendez RG, Williams K, Haffner SM, Stern MP, Hazuda HP. All-cause and cardiovascular mortality among Mexican-American and non-Hispanic White older participants in the San Antonio Heart Study- evidence against the "Hispanic paradox". Am J Epidemiol 2003;158:1048-57.

77. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. JAMA 2004;291:1238-45.

78. Hill JO. Understanding and addressing the epidemic of obesity: an energy balance perspective. Endocr Rev 2006;27:750-61.

79. Petersen KF, Shulman GI. Etiology of insulin resistance. Am J Med 2006;119:S10-6.

80. Hu FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, Willett WC. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. N Engl J Med 2001;345:790-7.

81. Malik VS, Popkin BM, Bray GA, Després J, Hu FB. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. Circulation 2010;121:1356-64.

82. Ford ES, Mokdad AH. Fruit and vegetable consumption and diabetes mellitus incidence among US adults. Prev Med 2001;32:33-9.

83. Physical Activity Guidelines Advisory Committee. Physical activity guidelines for Americans. Washington, DC: US Department of Health and Human Services 2008;15-34.

84. Abraido-Lanza AF, Chao MT, Florez KR. Do healthy behaviors decline with greater acculturation?: Implications for the Latino mortality paradox. Soc Sci Med 2005;61:1243-55.

85. Markides KS, Eschbach K. Aging, migration, and mortality: current status of research on the Hispanic paradox. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences 2005;60:S68-75.

86. Marquez DX, McAuley E. Gender and acculturation influences on physical activity in Latino adults. Annals of Behavioral Medicine 2006;31:138-44.

87. Ham SA, Yore MM, Kruger J, Heath GW, Moeti R. Physical activity patterns among Latinos in the United States: putting the pieces together. Prev Chronic Dis 2007;4:A92.

88. Ayala GX, Baquero B, Klinger S. A systematic review of the relationship between acculturation and diet among Latinos in the United States: implications for future research. J Am Diet Assoc 2008;108:1330-44.

89. Davidson JA, Kannel WB, Lopez-Candales A, Morales L, Moreno PR, Ovalle F, Rodriguez CJ, Rodbard HW, Rosenson RS, Stern M. Avoiding the looming Latino/Hispanic cardiovascular health crisis: a call to action. Journal of the cardiometabolic syndrome 2007;2:238-43.

90. Vespa J, Lewis JM, Kreider RM. America's families and living arrangements: 2012. Current Population Reports 2013;20-570.

91. Resnicow K, Braithwaite RL, Dilorio C, Glanz K, Glanz K, Rimer B, Lewis F. Applying theory to culturally diverse and unique populations. Health behavior and health education: Theory, research, and practice 2002;485-509.

92. Kumpfer KL, Alvarado R, Smith P, Bellamy N. Cultural sensitivity and adaptation in family-based prevention interventions. Prevention Science 2002;3:241-6.

93. Calzada EJ. Bringing culture into parent training with Latinos. Cognitive and Behavioral Practice 2010;17:167-75.

94. Halgunseth LC, Ispa JM, Rudy D. Parental control in Latino families: An integrated review of the literature. Child Dev 2006;77:1282-97.

95. Evenson KR, Sarmiento OL, Macon ML, Tawney KW, Ammerman AS. Environmental, policy, and cultural factors related to physical activity among Latina immigrants. Women Health 2002;36:43-56.

96. Keller C, Fleury J. Factors related to physical activity in Hispanic women. J Cardiovasc Nurs 2006;21:142-5.

97. Amesty SC. Barriers to physical activity in the Hispanic community. J Public Health Policy 2003;41-58.

98. Cullen KW, Baranowski T, Rittenberry L, Olvera N. Social-environmental influences on children's diets: results from focus groups with African-, Euro- and Mexican-American children and their parents. Health Educ Res 2000;15:581-90.

99. Hoerr SL, Hughes SO, Fisher JO, Nicklas TA, Liu Y, Shewchuk RM. International Journal of Behavioral Nutrition and Physical Activity. International Journal of Behavioral Nutrition and Physical Activity 2009;6:55.

100. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM, Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002;346:393-403.

101. Anonymous The Diabetes Prevention Program. Design and methods for a clinical trial in the prevention of type 2 diabetes. Diabetes Care 1999;22:623-34.

102. Orchard TJ, Temprosa M, Goldberg R, Haffner S, Ratner R, Marcovina S, Fowler S. The effect of metformin and intensive lifestyle intervention on the metabolic syndrome: the Diabetes Prevention Program randomized trial. Ann Intern Med 2005;142:611-9.

103. Hernan WH, Brandle M, Zhang P, Williamson DF, Matulik MJ, Ratner RE, Lachin JM, Engelgau MM, Diabetes Prevention Program Research Group. Costs associated with the primary prevention of type 2 diabetes mellitus in the diabetes prevention program. Diabetes Care 2003;26:36-47.

104. Katula JA, Vitolins MZ, Morgan TM, Lawlor MS, Blackwell CS, Isom SP, Pedley CF, Goff DC. The Healthy Living Partnerships to Prevent Diabetes study: 2-year outcomes of a randomized controlled trial. Am J Prev Med 2013;44:S324-32.

105. Vojta D, Koehler TB, Longjohn M, Lever JA, Caputo NF. A coordinated national model for diabetes prevention: linking health systems to an evidence-based community program. Am J Prev Med 2013;44:S301-6.

106. Stevens VJ, Obarzanek E, Cook NR, Lee I, Appel LJ, West DS, Milas NC, Mattfeldt-Beman M, Belden L, Bragg C. Long-term weight loss and changes in blood pressure: results of the Trials of Hypertension Prevention, phase II. Ann Intern Med 2001;134:1-11.

107. Cook NR, Cutler JA, Obarzanek E, Buring JE, Rexrode KM, Kumanyika SK, Appel LJ, Whelton PK. Long term effects of dietary sodium reduction on cardiovascular disease outcomes: observational follow-up of the trials of hypertension prevention (TOHP). BMJ 2007;334:885-8.

108. Osei-Assibey G, Kyrou I, Adi Y, Kumar S, Matyka K. Dietary and lifestyle interventions for weight management in adults from minority ethnic/non-White groups: a systematic review. Obesity Reviews 2010;11:769-76.

109. Betancourt JR, Carrillo JE, Green AR, Maina A. Barriers to health promotion and disease prevention in the Latino population. Clin Cornerstone 2004;6:16-29.

110. Blumenberg E, Smart M. Getting by with a little help from my friends… and family: immigrants and carpooling. Transportation 2010;37:429-46.

111. Pew Hispanic Center. National Survey of Latinos, Pew Internet and American Life Project. 2010.

112. Pew Hispanic Center. National Survey of Latinos. 2011.

113. Yancey AK, Ortega AN, Kumanyika SK. Effective recruitment and retention of minority research participants. Annu Rev Public Health 2006;27:1-28.

114. Huff RM, Kline MV, Peterson DV. Health promotion in multicultural populations: a handbook for practitioners and students. SAGE publications, 2014.
115. Barrera Jr M, Castro FG, Strycker LA, Toobert DJ. Cultural adaptations of behavioral health interventions: A progress report. J Consult Clin Psychol 2013;81:196.

116. Mier N, Ory MG, Medina AA. Anatomy of culturally sensitive interventions promoting nutrition and exercise in hispanics: a critical examination of existing literature. Health Promot Pract 2010;11:541-54.

117. Fitzgthhon ML, Gapstur SM, Knight SJ. Results of mujeres felices por ser saludables: a dietary/breast heafth randomized chnicail trial for latino women. Annals of Behavioral Medicine 2004;28:95-104.

118. Staten LK, Gregory-Mercado KY, Ranger-Moore J, Will JC, Giuliano AR, Ford ES, Marshall J. Provider counseling, health education, and community health workers: the Arizona WISEWOMAN project. Journal of women's health 2004;13:547-56.

119. Hovell MF, Mulvihill MM, Buono MJ, Liles S, Schade DH, Washington TA, Manzano R, Sallis JF. Culturally tailored aerobic exercise intervention for low-income Latinas. American Journal of Health Promotion 2008;22:155-63.

120. Elder JP, Ayala GX, Campbell NR, Slymen D, Lopez-Madurga ET, Engelberg M, Baquero B. Interpersonal and print nutrition communication for a Spanish-dominant Latino population: Secretos de la Buena Vida. Health Psychology 2005;24:49.

121. Golan M, Crow S. Targeting Parents Exclusively in the Treatment of Childhood Obesity: Long-Term Results. Obes Res 2004;12:357-61.

122. McLean N, Griffin S, Toney K, Hardeman W. Family involvement in weight control, weight maintenance and weight-loss interventions: a systematic review of randomised trials. Int J Obes 2003;27:987-1005.

123. Taylor WC, Baranowski T, Sallis JF. Family determinants of childhood physical activity: a social-cognitive model. 1994.

124. Klohe-Lehman DM, Freeland-Graves J, Clarke KK, Cai G, Voruganti VS, Milani TJ, Nuss HJ, Proffitt JM, Bohman TM. Low-income, overweight and obese mothers as agents of change to improve food choices, fat habits, and physical activity in their 1-to-3-year-old children. J Am Coll Nutr 2007;26:196-208.

125. Fitzgibbon ML, Stolley MR, Schiffer L, Kong A, Braunschweig CL, Gomez-Perez SL, Odoms-Young A, Van Horn L, Christoffel KK, Dyer AR. Family-based hip-hop to health: Outcome results. Obesity 2013;21:274-83.
126. Ball K, Jeffery RW, Abbott G, McNaughton SA, Crawford D. Is healthy behavior contagious: associations of social norms with physical activity and healthy eating. Int J Behav Nutr Phys Act 2010;7:86.

127. Kitzman-Ulrich H, Wilson DK, George SMS, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev 2010;13:231-53.

128. Bauer KW, Nelson MC, Boutelle KN, Neumark-Sztainer D. Parental influences on adolescents' physical activity and sedentary behavior: longitudinal findings from Project EAT-II. Int J Behav Nutr Phys Act 2008;5:12,5868-5-12.

129. Jago R, Fox KR, Page AS, Brockman R, Thompson JL. Parent and child physical activity and sedentary time: do active parents foster active children? BMC Public Health 2010;10:194,2458-10-194.

130. Birch LL, Anzman SL. Learning to eat in an obesogenic environment: a developmental systems perspective on childhood obesity. Child Development Perspectives 2010;4:138-43.

131. Pearson N, Biddle SJ, Gorely T. Family correlates of fruit and vegetable consumption in children and adolescents: a systematic review. Public Health Nutr 2009;12:267-83.

132. Bere E, Klepp KI. Changes in accessibility and preferences predict children's future fruit and vegetable intake. Int J Behav Nutr Phys Act 2005;2:15.

133. Bere E, Klepp K. Correlates of fruit and vegetable intake among Norwegian schoolchildren: parental and self-reports. Public Health Nutr 2004;7:991-8.

134. Hannon PA, Bowen DJ, Moinpour CM, McLerran DF. Correlations in perceived food use between the family food preparer and their spouses and children. Appetite 2003;40:77-83.

135. Bellows-Riecken KH, Rhodes RE. A birth of inactivity? A review of physical activity and parenthood. Prev Med 2008;46:99-110.

136. Labrecque J, Ricard L. Children's influence on family decision-making: a restaurant study. Journal of Business Research 2001;54:173-6.

137. Turner JJ, Kelly J, McKenna K. Food for thought: parents' perspectives of child influence. Br Food J 2006;108:181-91.
138. Epstein LH. Family-based behavioural intervention for obese children. Int J Obes Relat Metab Disord 1996;20 Suppl 1:S14-21.

139. Golan MM. Impact of Treatment for Childhood Obesity on Parental Risk Factors for Cardiovascular Disease. Prev Med 1999;29:519; 519,526; 526.

140. Boudreau ADA, Kurowski DS, Gonzalez WI, Dimond MA, Oreskovic NM. Latino families, primary care, and childhood obesity: a randomized controlled trial. Am J Prev Med 2013;44:S247-57.

141. Wright K, Norris K, Newman Giger J, Suro Z. Improving healthy dietary behaviors, nutrition knowledge, and self-efficacy among underserved school children with parent and community involvement. Childhood Obesity (Formerly Obesity and Weight Management) 2012;8:347-56.

142. Slusser W, Frankel F, Robison K, Fischer H, Cumberland WG, Neumann C. Pediatric overweight prevention through a parent training program for 2-4 year old Latino children. Childhood Obesity (Formerly Obesity and Weight Management) 2012;8:52-9.

143. O'Connor T, Hilmers A, Watson K, Baranowski T, Giardino A. Feasibility of an obesity intervention for paediatric primary care targeting parenting and children: Helping HAND. Child: care, health and development 2013;39:141-9.

144. Shaibi GQ, Konopken Y, Hoppin E, Keller CS, Ortega R, Castro FG. Effects of a culturally grounded community-based diabetes prevention program for obese Latino adolescents. Diabetes Educ 2012;38:504-12.

145. Alexander AG, Grant WL, Pedrino KJ, Lyons PE. A prospective multifactorial intervention on subpopulations of predominately hispanic children at high risk for obesity. Obesity 2014;22:249-53.

146. Haines J, McDonald J, O'Brien A, Sherry B, Bottino CJ, Schmidt ME, Taveras EM. Healthy habits, happy homes: randomized trial to improve household routines for obesity prevention among preschool-aged children. JAMA pediatrics 2013;167:1072-9.

147. Cong Z, Feng D, Liu Y, Esperat MC. Sedentary behaviors among Hispanic children: influences of parental support in a school intervention program. American Journal of Health Promotion 2012;26:270-80.

148. Olvera N, Bush JA, Sharma SV, Knox BB, Scherer RL, Butte NF. BOUNCE: A Community-based Mother–daughter Healthy Lifestyle Intervention for Low-income Latino Families. Obesity 2010;18:S102-4.

149. Sorkin DH, Mavandadi S, Rook KS, Biegler KA, Kilgore D, Dow E, Ngo-Metzger Q. Dyadic collaboration in shared health behavior change: the effects of a randomized trial to test a lifestyle intervention for high-risk Latinas. Health Psychol 2014;33:566-75.

150. Fitzgibbon ML, Stolley MR, Avellone ME, Sugerman S, Chavez N. Involving parents in cancer risk reduction: a program for Hispanic American families. Health Psychology 1996;15:413.

151. Davis AM, Stough CO, Black WR, Dean K, Sampilo M, Simpson S, Landrum Y. Outcomes of a Weight Management Program Conjointly Addressing Parent and Child Health. Children's Health Care 2015.

152. Anderson JD, Newby R, Kehm R, Barland P, Hearst MO. Taking steps together: a family- and community-based obesity intervention for urban, multiethnic children. Health Educ Behav 2015;42:194-201.

153. Davis AM, Daldalian MC, Mayfield CA, Dean K, Black WR, Sampilo ML, Gonzalez-Mijares M, Suminski R. Outcomes from an Urban Pediatric Obesity Program Targeting Minority Youth: The Healthy Hawks Program. Childhood Obesity 2013;9:492-500.

154. Dickin KL, Hill TF, Dollahite JS. Practice-Based Evidence of Effectiveness in an Integrated Nutrition and Parenting Education Intervention for Low-Income Parents. Journal of the Academy of Nutrition and Dietetics 2014;114:945-50.

155. Ziebarth D, Healy-Haney N, Gnadt B, Cronin L, Jones B, Jensen E, Viscuso M. A community-based family intervention program to improve obesity in Hispanic families. WMJ 2012;111:261-6.

156. Arredondo EM, Elder JP, Ayala GX, Campbell N, Baquero B, Duerksen S. Is parenting style related to children's healthy eating and physical activity in Latino families? Health Educ Res 2006;21:862-71.

157. USDA U. Dietary guidelines for Americans. Department of Agriculture, Department of Health and Human ServicesU.S.Government Printing Office, Washington 2010.

158. American Heart Association Nutrition Committee, Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, Franklin B, Kris-Etherton P, Harris WS, et al. Diet and lifestyle recommendations revision 2006: a scientific statement from the American Heart Association Nutrition Committee. Circulation 2006;114:82-96.

159. Skinner BF. Operant behavior. Am Psychol 1963;18:503.

160. Wetter AC, Goldberg JP, King AC, Sigman-Grant M, Baer R, Crayton E, Devine C, Drewnowski A, Dunn A, Johnson G. How and why do individuals make food and physical activity choices? Nutr Rev 2001;59:S11-20.

161. McGraw KJ, Tourville EA, Butler MW. A quantitative comparison of the commonly used methods for extracting carotenoids from avian plasma. Behav Ecol Sociobiol 2008;62:1991-2002.

162. Miller NJ, Rice-Evans CA. Factors influencing the antioxidant activity determined by the ABTS radical cation assay. Free Radic Res 1997;26:195-9.

163. Jacks DE, Topp R, Moore JB. Prediction of VO2 peak using a sub-maximal bench step test in children. Clin Kinesiol 2011;65:68-75.

164. Beutner F, Ubrich R, Zachariae S, Engel C, Sandri M, Teren A, Gielen S. Validation of a brief step-test protocol for estimation of peak oxygen uptake. Eur J Prev Cardiol 2015;22:503-12.

165. Sievert YA, Schakel SF, Buzzard IM. Maintenance of a nutrient database for clinical trials. Control Clin Trials 1989;10:416-25.

166. Schakel SF, Sievert YA, Buzzard IM. Sources of data for developing and maintaining a nutrient database. J Am Diet Assoc 1988;88:1268-71.

167. Schakel SF, Buzzard IM, Gebhardt SE. Procedures for estimating nutrient values for food composition databases. Journal of Food Composition and Analysis 1997;10:102-14.

168. Plasqui GG. Physical Activity Assessment With Accelerometers: An Evaluation Against Doubly Labeled Water**. Obesity (Silver Spring, Md.) 2007;15:2371-9.

169. Matthews CE, Chen KY, Freedson PS, Buchowski MS, Beech BM, Pate RR, Troiano RP. Amount of time spent in sedentary behaviors in the United States, 2003–2004. Am J Epidemiol 2008;167:875-81.

170. Freedson PS, Melanson E, Sirard J. Calibration of the Computer Science and Applications, Inc. accelerometer. Med Sci Sports Exerc 1998;30:777-81.

171. Matthews CE, Ainsworth BE, Thompson RW, Bassett DR,Jr. Sources of variance in daily physical activity levels as measured by an accelerometer. Med Sci Sports Exerc 2002;34:1376-81.
172. Grundy SSM. Definition of Metabolic Syndrome: Report of the National Heart, Lung, and Blood Institute/American Heart Association Conference on Scientific Issues Related to Definition. Circulation (New York, N.Y.) 2004;109:433-8.

173. Thompson FE, Subar AF, Coulston A, Boushey C. Dietary assessment methodology. Nutrition in the Prevention and Treatment of Disease 2008;2:3-39.

174. Glanz K, Basil M, Maibach E, Goldberg J, Snyder D. Why Americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. J Am Diet Assoc 1998;98:1118-26.

175. Kristal AR, Glanz K, Curry SJ, Patterson RE. How can stages of change be best used in dietary interventions? J Am Diet Assoc 1999;99:679-84.

176. Kusano C, Ferrari B. Total antioxidant capacity: a biomarker in biomedical and nutritional studies. J Cell Mol Biol 2008;7:1-15.

177. Ceriello A, Motz E. Is oxidative stress the pathogenic mechanism underlying insulin resistance, diabetes, and cardiovascular disease? The common soil hypothesis revisited. Arterioscler Thromb Vasc Biol 2004;24:816-23.

178. Lin MT, Beal MF. Mitochondrial dysfunction and oxidative stress in neurodegenerative diseases. Nature 2006;443:787-95.

179. Cai L, Kang YJ. Oxidative stress and diabetic cardiomyopathy. Cardiovascular toxicology 2001;1:181-93.

180. Valtuena S, Pellegrini N, Franzini L, Bianchi MA, Ardigo D, Del Rio D, Piatti P, Scazzina F, Zavaroni I, Brighenti F. Food selection based on total antioxidant capacity can modify antioxidant intake, systemic inflammation, and liver function without altering markers of oxidative stress. Am J Clin Nutr 2008;87:1290-7.

181. Cao G, Booth SL, Sadowski JA, Prior RL. Increases in human plasma antioxidant capacity after consumption of controlled diets high in fruit and vegetables. Am J Clin Nutr 1998;68:1081-7.

182. Fernández-García E, Carvajal-Lérida I, Jarén-Galán M, Garrido-Fernández J, Pérez-Gálvez A, Hornero-Méndez D. Carotenoids bioavailability from foods: From plant pigments to efficient biological activities. Food Res Int 2012;46:438-50.

183. Gallicchio L, Boyd K, Matanoski G, Tao XG, Chen L, Lam TK, Shiels M, Hammond E, Robinson KA, Caulfield LE, et al. Carotenoids and the risk of developing lung cancer: a systematic review. Am J Clin Nutr 2008;88:372-83.
184. Toniolo P, Van Kappel AL, Akhmedkhanov A, Ferrari P, Kato I, Shore RE, Riboli E. Serum carotenoids and breast cancer. Am J Epidemiol 2001;153:1142-7.

185. Voutilainen S, Nurmi T, Mursu J, Rissanen TH. Carotenoids and cardiovascular health. Am J Clin Nutr 2006;83:1265-71.

186. De Waart FG, Schouten EG, Stalenhoef AF, Kok FJ. Serum carotenoids, alpha-tocopherol and mortality risk in a prospective study among Dutch elderly. Int J Epidemiol 2001;30:136-43.

187. Abdel-Aal EM, Akhtar H, Zaheer K, Ali R. Dietary sources of lutein and zeaxanthin carotenoids and their role in eye health. Nutrients 2013;5:1169-85.

188. Arab L, Steck S. Lycopene and cardiovascular disease. Am J Clin Nutr 2000;71:1691S,5S; discussion 1696S-7S.

189. Veda S, Kamath A, Platel K, Begum K, Srinivasan K. Determination of bioaccessibility of β-carotene in vegetables by in vitro methods. Molecular nutrition & food research 2006;50:1047-52.

190. Burri BJ, Chang JS, Neidlinger TR. β-Cryptoxanthin-and α-carotene-rich foods have greater apparent bioavailability than β-carotene-rich foods in Western diets. Br J Nutr 2011;105:212-9.

191. Watzl B, Kulling SE, Moseneder J, Barth SW, Bub A. A 4-wk intervention with high intake of carotenoid-rich vegetables and fruit reduces plasma C-reactive protein in healthy, nonsmoking men. Am J Clin Nutr 2005;82:1052-8.

192. Ruggiero L, Oros S, Choi YK. Community-based translation of the diabetes prevention program's lifestyle intervention in an underserved Latino population. Diabetes Educ 2011;37:564-72.

193. Gómez-Ambrosi J, Silva C, Galofré JC, Escalada J, Santos S, Gil MJ, Valentí V, Rotellar F, Ramírez B, Salvador J. Body adiposity and type 2 diabetes: increased risk with a high body fat percentage even having a normal BMI. Obesity 2011;19:1439-44.

194. Karelis AD, St-Pierre DH, Conus F, Rabasa-Lhoret R, Poehlman ET. Metabolic and body composition factors in subgroups of obesity: what do we know? The Journal of Clinical Endocrinology & Metabolism 2004;89:2569-75.

195. Bergman RN, Kim SP, Catalano KJ, Hsu IR, Chiu JD, Kabir M, Hucking K, Ader M. Why visceral fat is bad: mechanisms of the metabolic syndrome. Obesity 2006;14:16S-9S.
196. Borel A, Nazare J, Smith J, Alméras N, Tremblay A, Bergeron J, Poirier P, Després J. Improvement in insulin sensitivity following a 1-year lifestyle intervention program in viscerally obese men: contribution of abdominal adiposity. Metab Clin Exp 2012;61:262-72.

197. Goodpaster BH, DeLany JP, Otto AD, Kuller L, Vockley J, South-Paul JE, Thomas SB, Brown J, McTigue K, Hames KC. Effects of diet and physical activity interventions on weight loss and cardiometabolic risk factors in severely obese adults: a randomized trial. JAMA 2010;304:1795-802.

198. Gaesser GGA. Exercise and Diet, Independent of Weight Loss, Improve Cardiometabolic Risk Profile in Overweight and Obese Individuals. The Phys Sp Med 2011;39.

199. Meneton P, Jeunemaitre X, de Wardener HE, MacGregor GA. Links between dietary salt intake, renal salt handling, blood pressure, and cardiovascular diseases. Physiol Rev 2005;85:679-715.

200. Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett DR,Jr, Tudor-Locke C, Greer JL, Vezina J, Whitt-Glover MC, Leon AS. 2011 Compendium of Physical Activities: a second update of codes and MET values. Med Sci Sports Exerc 2011;43:1575-81.

201. Bravata DM, Smith-Spangler C, Sundaram V, Gienger AL, Lin N, Lewis R, Stave CD, Olkin I, Sirard JR. Using pedometers to increase physical activity and improve health: a systematic review. JAMA 2007;298:2296-304.

202. Lee DC, Sui X, Church TS, Lee IM, Blair SN. Associations of cardiorespiratory fitness and obesity with risks of impaired fasting glucose and type 2 diabetes in men. Diabetes Care 2009;32:257-62.

203. Lee CD, Blair SN, Jackson AS. Cardiorespiratory fitness, body composition, and all-cause and cardiovascular disease mortality in men. Am J Clin Nutr 1999;69:373-80.
204. Kenney WL, Wilmore J, Costill D. Physiology of Sport and Exercise 6th Edition. Human kinetics, 2015.

205. Ayala GX. Effects of a Promotor-Based Intervention to Promote Physical Activity: Familias Sanas y Activas. Am J Public Health 2011;101:2261.

206. Avila P, Hovell MF. Physical activity training for weight loss in Latinas: a controlled trial. Int J Obes Relat Metab Disord 1994;18:476-82.
207. Anez LM, Paris M,Jr, Bedregal LE, Davidson L, Grilo CM. Application of cultural constructs in the care of first generation Latino clients in a community mental health setting. J Psychiatr Pract 2005;11:221-30.

208. Schoeller DA. Limitations in the assessment of dietary energy intake by self-report. Metab Clin Exp 1995;44:18-22.

209. Sallis JF, Saelens BE. Assessment of physical activity by self-report: status, limitations, and future directions. Res Q Exerc Sport 2000;71:1-14.

210. Illner AK, Freisling H, Boeing H, Huybrechts I, Crispim SP, Slimani N. Review and evaluation of innovative technologies for measuring diet in nutritional epidemiology. Int J Epidemiol 2012;41:1187-203.

211. Golan M, Weizman A. Familial approach to the treatment of childhood obesity: conceptual model. J Nutr Educ 2001;33:102-7.

APPENDIX A

REVIEW OF FAMILY-BASED BEHAVIORAL INTERVENTIONS ON DIET, PA, FITNESS, BODY COMPOSITION, AND METABOLIC OUTCOMES AMONG LATINO PARENTS

Appendix A. Review of family-based behavioral interventions on diet, PA, fitness, body composition, and metabolic outcomes among Latino parents

Reference	Design and Setting	Sample	Intervention	Outcomes			
				Diet	PA/Fitness	Weight/Body Composition	Metabolic Outcomes
Olvera et al., 2012 (148)	2-group RCT; 12 wks; (N=46). Community centers and schools	Latino mothers with 7-13 year old daughter. 76% retention. 35.7 years, 100% foreign born, 62% Spanish preference, 88% OW	Intervention: *BOUNCE* • 3 x wk, 90 min sessions. • 45 min of nutrition education/behavioral counseling • 45 min of exercise participation. Grounded in SCT Comparison: • Same as intervention, but 1 x wk		Rockport Walk Est. VO2: NS between groups Self-Report PA: NSD between groups		
Nader et al., 1989 (40)	2-group cluster RCT; 1 year; (N=206). School	Parents of 5th and 6th grade children. 91% retention, 54% Latino. Analyses conducted on Latino group.	Intervention: • 12 weekly sessions, followed by 6 sessions in 9 months • Grounded in SCT • 25 min family exercise • 25 minute parent nutrition education taught stop light method of diet classification • 25 minute behavioral session taught self-monitoring, goal setting, and problem solving • Low salt/low saturated fat snack Control: • Passive	<u>3 day food record</u> Improvement in 3 day salt score, p=0.001	Sub-maximal treadmill test: NSD between groups	BMI: NSD between groups	SBP: I= -2.2 mm Hg, p=0.03 DBP: I= -3.3 mm Hg, p=0.006 Cholesterol: NSD between groups,

Appendix A. (Cont'd)

Reference	Design and Setting	Sample	Intervention	Outcomes			
				Diet	PA/Fitness	Weight/Body Composition	Metabolic Outcomes
Ziebarth et al., 2012 (155)	1-group pre-post; 8 wks; (N=57). Not specified	Latino parents with school-aged children. Retention 96%. 89% female, BMI 28.0 kg/m^2	*We Can!* 1x wk. • 40 min separate parent and child classroom based content, 40 min of combined PA, and a healthy family dinner • Objectives of the program were to improve dietary choices, increase PA and reduce screen time			Waist Circumference: -0.54 inches, p=0.03 BMI: -0.35 kg/m^2, p=0.01	SBP: -3.5mm Hg, p=0.01 DBP: -2.4 mm Hg, p=0.04 Glucose: -3.1 mg/dl, p=0.02
Klohe-Lehman et al., 2007 (124)	1-group pre-post; I: 8 wks, FU: 24 wks; (N=235). Not specified	Mothers with BMI ≥25kg/m^2 with 1-3 year old child. 39% retention. 63% Latino, 76% obese, BMI 34.9 kg/m^2	• 1 x wk, 2 hour sessions taught by RDs • 15 min weigh in, followed by 75 min of discussion and activities, and 30 min of PA. • Gounded in SCT and taught self-monitoring, stimulus control, contingency management, goal setting, and relapse prevention. • Nutrition skills included meal planning, low-fat cooking, and recipe modification	<u>FFQ Servings</u> Fruits: NS Vegetables: NS Sweetened Beverages: -0.9, p<0.001	Pedometer steps: +3845 p<0.001	Weight: -2.7 kg, 8 wk; -2.8, 24 wk; p<0.05	

Appendix A. (Cont'd)

Reference	Design and Setting	Sample	Intervention	Outcomes			
				Diet	PA/Fitness	Weight/Body Composition	Metabolic Outcomes
Davis et al., 2013 (153)	1-group pre-post; I: 12 wks, FU: 1 year; (N=210). Clinic service hospital	Parents of 2-18 year old OW children. 67% 12 wk retention, 30% 1 year retention. 58% Latino, 54% Spanish preference, 7% no insurance, 74% public insurance, BMI 33.5 kg/m^2	*Healthy Hawks Program* • 1 x wk, 2 hr sessions • Focus on child. Each class had a behavioral (i.e. goal setting, positive reinforcement), nutrition (stop light diet), and exercise topic for the first hour delivered to parents and children separately • Group exercise for the second hour with parents and children together			BMI change (kg/m^2): -0.35, 12 wk, p<0.001; -0.48, 1 yr, p>0.05	
Davis et al., 2015 (151)	2-group RCT; 12 wks; (N=80). Clinic service hospital	Parents of 2-18 year old OW children. 80% retention. 38.5 years, 58% Latino, 52% Spanish preference, 74% public insurance, BMI 33.5 kg/m^2	Intervention: *Healthy Hawks Super* • 1 x wk, 2 hr sessions. • First 6 wks focus on parent behavior, last 6 wks focus on child • Parent sessions had 60 min behavioral (i.e. goal setting, positive reinforcement), nutrition (stop light diet), and exercise topic • 60 family exercise Control: • Intervention wait-list			BMI change (kg/m^2): I= -1.6; C= -0.6; NSD between groups	

Appendix A. (Cont'd)

Reference	Design and Setting	Sample	Intervention	Outcomes		
				Diet	PA/Fitness	Weight/Body Composition
Cousins et al., 1992 (65)	3-group RCT; 1 year; (N=168). Not Specified	168 Latinas 20-100% OW w/ pre-school aged child Age = 33.4±SD y BMI 31.2±SD kg/m^2	*Cuidando el Corazón* Individual intervention group: • 24 weekly + 6 monthly classes (group exercise, food tastings, cooking demonstrations, and behavior modification techniques) • Taught by bilingual RDs • Focus on adopting low fat dietary pattern Family intervention group: • Same as above, but focus on family • Children attended separate classes; spouses encouraged to attend Comparison group: • Printed information-only			BMI: Reduction ($p<0.05$) at 3, 6, and 12 months in FI and IndI (vs. C) FI (3, -3.0 kg; 6, -4.5 kg; 12, -3.8 kg); IndI (3, -2.6 kg; 6, -3.3 kg; 12, -2.1 kg) C (3, -0.9 kg; 6, -0.2 kg; 12, -0.7 kg)
Sorkin et al., 2014 (149)	2-group RCT; 16 wk; (N=89). Federally qualified health centers	Latina mother-daughter dyads ≥ 18 years old, mother has Type 2 diabetes, daughter BMI ≥ 25 kg/m^2, pair resides < 25 mi from each other, not pregnant. 52.7 years, 95% foreign born, 73% Spanish only, 83% less than high school.	Intervention: • 1 x wk • 4 group behavior change sessions, 8 home visits, and 4 booster telephone calls modeled after DPP • Emphasis on weight loss by meeting personalized calorie goal and accumulating 150 min of MVPA/wk Comparison: National Diabetes Education Program Materials	<u>Block Alive Screener</u> Glycemic Load: I= -14.0 g; C= +8.2 g; $p<0.05$ SFat: I= -2.4 g; C= +1.4 g; $p<0.05$		Weight: I= -1.6 kg; C= +0.6 kg; $p<0.05$

Appendix A. (Cont'd)

Reference	Design and Setting	Sample	Intervention	Outcomes		
				Diet	PA/Fitness	Weight/Body Composition
Cousins et al., 1992 (65)	3-group RCT; 1 year; (N=168). Not Specified	168 Latinas 20-100% OW w/ pre-school aged child Age = 33.4±SD y BMI 31.2±SD kg/m^2	*Cuidando el Corazón* Individual intervention group: • 24 weekly + 6 monthly classes (group exercise, food tastings, cooking demonstrations, and behavior modification techniques) • Taught by bilingual RDs • Focus on adopting low fat dietary pattern Family intervention group: • Same as above, but focus on family • Children attended separate classes; spouses encouraged to attend Comparison group: • Printed information-only			BMI: Reduction ($p<0.05$) at 3, 6, and 12 months in FI and IndI (vs. C) FI (3, -3.0 kg; 6, -4.5 kg; 12, -3.8 kg); IndI (3, -2.6 kg; 6, -3.3 kg; 12, -2.1 kg) C (3, -0.9 kg; 6, -0.2 kg; 12, -0.7 kg)
Sorkin et al., 2014 (149)	2-group RCT; 16 wk; (N=89). Federally qualified health centers	Latina mother-daughter dyads ≥ 18 years old, mother has Type 2 diabetes, daughter BMI ≥ 25 kg/m^2, pair resides < 25 mi from each other, not pregnant. 52.7 years, 95% foreign born, 73% Spanish only, 83% less than high school.	Intervention: • 1 x wk • 4 group behavior change sessions, 8 home visits, and 4 booster telephone calls modeled after DPP • Emphasis on weight loss by meeting personalized calorie goal and accumulating 150 min of MVPA/wk Comparison: National Diabetes Education Program Materials	<u>Block Alive Screener</u> Glycemic Load: I= -14.0 g; C= +8.2 g; $p<0.05$ SFat: I= -2.4 g; C= +1.4 g; $p<0.05$		Weight: I= -1.6 kg; C= +0.6 kg; $p<0.05$

Appendix A. (Cont'd)

Reference	Design and Setting	Sample	Intervention	Outcomes			
				Diet	PA/Fitness	Weight/Body Composition	Metabolic Outcomes
		foreign born, 73% Spanish only, 83% less than high school.					
Dickin et al., 2014 (154)	1-group pre-post; 8 wks; (N=210) Expanded Food and Nutrition Education Program sites	Parents of 3-11 year old children. Retention not described. 35.3 years, 100% below 185% FPL, 66% Latino, 93% female, 46% less than HS education.	*Healthy Children, Healthy Families: Parents Making a Difference* • 1 x wk, 90 min sessions • Parenting and nutrition education • Focused on weight maintenance along with building self-efficacy and goal setting skills • Promoted authoritative parenting style. Role playing and hands-on activities were used in addition to weekly challenges, goal setting, and skill development	<u>5 point likert scale</u> Significant increase in fruit, vegetables, and low fat dairy and a reduction in soda, $p<0.001$.	<u>5 point likert scale</u> 30 minutes of PA/day: NS		
Anderson et al., 2014 (152)	Pre-post Community recreation centers	N=105 adults w/ 7-17 year old OW child Age = 38.0±SD y 79% Latino 76% female 48% uninsured, 26% public insurance BMI 33.5±SD kg/m^2	*Taking Steps Together*. • 16 weekly 2 hour sessions (40 min of cooking and eating, 40 min of nutrition education, and 40 min of PA) • Attended by parents and children together • Social media used to promote social support	<u>Servings</u> Fruit: +0.7, $p=0.006$ Vegetables: +0.8, $p<0.001$ Sugared Drinks: -0.6, $p=0.002$	Screen time: -0.7 hr/day, $p=0.041$ Days w/ 30 min of activity: +1.3, $p=0.001$	BMI: +0.5 kg/m^2, NS	

Appendix A. (Cont'd)

Reference	Design and Setting	Sample	Intervention	Outcomes			
				Diet	PA/Fitness	Weight/Body Composition	Metabolic Outcomes
Fitzgibbon et al., 1996 (150)	2-group RCT; 12 wks; (N=38). The site of a literacy training program	Latino mothers of 7-12 year old children. 95% retention. 35.0 years, 84% foreign born, 43% Spanish preferred, 76% on public assistance, 53% no high school education, 28.7 kg/m^2.	Intervention: • 1 x wk, 1 hr cancer risk reduction session • Parents and children attended together • Curriculum focused on adopting a low fat, high fiber diet • Included several hands-on activities and skill building opportunities Control: • Standard pamphlets on health behaviors and nutrition by mail	<u>24 hour recall checklist</u> Fruit and Vegetables (servings): I= +0.6; C= +0.6; NSD between groups <u>FFQ</u> Fat % cal: I= -5%; C= +0.4%; $p<0.05$ SFat % cal: I= -1.0%; C= +0.7%; $p<0.05$			

Appendix A. (Cont'd)

Reference	Design and Setting	Sample	Intervention	Outcomes			
				Diet	PA/Fitness	Weight/Body Composition	Metabolic Outcomes
Fitzgibbon et al., 2013 (125)	2-group RCT; 14 wks; (N=142). Head Start preschoo ls	Latino parents with child in Head Start preschool. 87% retention. 32.8 years, 93% female, BMI 30.3 kg/m^2.	Intervention *Hip Hop to Health Jr:* • 1 x wk, 6 wks, 90 min sessions • Focus on child. 60 min of nutrition and PA behavior change content, 30 min of PA • Content was grounded in SCT and HBM • Focused on risks of childhood obesity, importance of modeling, reinforcement and creating a healthy home environment • Also received weekly newsletters for 14 weeks Control: • Weekly general health newsletters for 14 weeks	<u>24 hour recall</u> NSD between groups for fruit, vegetables, fiber, or % energy from fat.	Accelerom eter measured MVPA: NSD between groups Screen time: NSD between groups		

Abbreviations: Wk –Week; Hr – Hour; Min – Minute; SD – Standard deviation; NS – Not significant; NSD – No significant difference; RCT – Randomized controlled trial; FU – Follow up; OW – Overweight; PA – Physical activity; MVPA – Moderate and vigorous PA; kg – Kilograms; g – grams; Sat – Saturated fat; I – Intervention; HS – High School; C – Control; F – Family; Ind – Individual; BMI – Body mass index; RD – Registered dietitian; FFQ – Food frequency questionnaire; SCT – Social cognitive theory; DPP – Diabetes Prevention Program; FPL – Federal poverty line

APPENDIX B

INFORMED CONSENT FORM

Arizona State University
Athletes for Life 3
Adult Consent Form

INTRODUCTION:
The purpose of this form is to provide you with important information that may affect your decision regarding you and your child's participation and to record the consent of those who agree to participate and give permission for their child to participate in this study.

RESEARCHERS:
Drs. Noe Crespo, Sonia Vega-López, and Gabriel Shaibi are professors in the School of Nutrition and Health Promotion at Arizona State University, in collaboration with the City of Phoenix Parks and Recreation Department's South Mountain Community Center

DESCRIPTION OF THE RESEARCH STUDY:
We are inviting parent-child pairs to participate in a research study to test the effectiveness of a family fitness and nutrition program. If you and your child decide to participate, you will be randomly assigned (by chance) to be in one of two groups, either the "immediate program treatment" group or the "wait-list" group.

Both groups will participate in a 12-week fitness and nutrition program. The "immediate program" group will begin the 12-week fitness and nutrition program after completing the first set of measurements (described below). The "wait-list" group will wait to begin the 12-week fitness and nutrition program until all measurements have been completed, approximately 24 weeks after the completion of the first set of measurements.

Data from all participants (both immediate program group and wait-list group) will be collected in four phases: before the immediate program group starts the program (week 0) and at 6, 12, and 24 weeks, thereafter. The measurements will take place in three separate visits and will be collected before the immediate program group starts the program and at week 12.

Fitness and Nutrition Program:
Child Participation: Each session will consist of an 80-minute physical activity and a 10-minute interactive nutrition lesson. The sessions include group activities, games, and exercises designed to improve your child's fitness, sports skills, and wellbeing. These games and activities will provide information about the importance of eating nutritious foods. Your child may be given information from some of the sessions to share with the family.

Parent Participation. The parent portion consists of 45 minutes of interactive nutrition lessons with cooking demonstrations and taste tests. The other 45 minutes will be spent doing physical activities to help improve your health and fitness level.

At the end of the program your family will be invited to participate in a youth Olympics event to showcase you and your child's athletic skills developed over the course of the program.

We expect to have about 160 families enrolled in this study over four years. If assigned to the immediate program group, you and your child's participation will take approximately 28 weeks. If assigned to the wait-list group participation will take approximately 40 weeks (28 weeks of wait period plus 12 weeks of the program).

In order to evaluate this program we will ask each group to complete the following measurements.

Initial Procedures Before the start of the Program (Week 0)

Visit 1 (approximately 1 hour total)

Location: Your Home

- You and your child will receive a full explanation of the study and if both of you agree to participate; you and your child will sign a written informed consent.
- You (parent) will fill out a questionnaire about you and your child's diet and physical activity habits
- (Optional) Home food inventory (approximately 45 minutes) – With your permission, a research assistant will go to your home to conduct a brief inventory of the food items that are available in your kitchen

Visit 2 (approximately 1 hour total)

Location: ASU Nutrition & Health Promotion Laboratory (downtown Phoenix)

- You and your child will be asked to fast (not consume foods or drinks) for at least 8 hours before the visit and you will be offered a light snack during the visit
- (Child) We will apply numbing cream at the spot of the blood draw
- Post-pubertal females will be asked to provide a urine sample to conduct a pregnancy test
- (Adult and child) We will ask you to sit down for 5 minutes after which we will measure blood pressure
- (Adult and child) Full body DEXA (x-ray) scan to measure total and abdominal body fat
- (Adult and child) We will measure height, weight, and waist circumference
- (Adult and child) We will draw blood (approximately 2 tablespoons from adults and 1 tablespoon from children)
- (Adult and child) Fitness assessment - stepping up and down from a 12 inch step while we measure your heart rate

Visit 3 (approximately 45 minutes)

Location: South Mountain Community Center

- Activity warm-up for exercise

- (Adult and child) Fitness assessment – same as the fitness assessment from the last visit
- (Adult and child) Run/walk 1 mile while being timed
- (Adult and child) Activity trackers (Accelerometers) - You and your child will be given an accelerometer that we will ask you to wear for one week to measure physical activity
- We will also ask you to fill out a 3-day food record in which you will write down all the foods and drinks you consume for the week before the start of the program.

Week 6 Procedures (takes place during intervention session)

Location: South Mountain Community Center

- (Adult and child) Repeat height, weight, and waist circumference measurements
- (Adult and child) Repeat a run/walk 1 mile while being timed

Week 12 Procedures

Visit 1 (approximately 1 hour and 30 minutes)

Location: South Mountain Community Center

- (Adult and child) Activity warm-up
- (Adult and child) Fitness assessment (step test)– same as the fitness assessment from the initial visit
- (Adult and child) Run/walk 1 mile while being timed
- You (parent) will fill out a questionnaire about you and your child's diet and physical activity habits
- (Adult only) We will also ask you to fill out a 3-day food record for the week following the last program session
- (Adult and child) Activity trackers (Accelerometers) - You will be given an accelerometer that we will ask you and your child to wear for one week to measure physical activity
- Immediate program group only – Parent Interview. We will interview to ask your opinions about your experience with the program.

Visit 2 (approximately 30 minutes total)

Location: ASU Nutrition & Health Promotion Laboratory (downtown Phoenix)

- You and your child will be asked to fast (not consume foods or drinks) for at least 8 hours before the visit and you will be offered a light snack during the visit
- Post-pubertal females will be asked to provide a urine sample to conduct a pregnancy test
- (Adult and child) We will ask you to sit down for 5 minutes after which we will measure blood pressure
- (Adult and child) Full body DEXA scan to measure total and abdominal body fat
- (Adult and child) We will measure height, weight, and waist circumference
  (Adult and child) We will draw blood (approximately 2 tablespoons from adults and 1 tablespoon from children)

Visit 3 (approximately 1 hour total)

- (Optional) Home food inventory – With your permission, a research assistant will conduct a brief home food inventory of the food items that are available in your kitchen

Week 24 Procedures (approximately 45 minutes)
Location: South Mountain Community Center

- (Adult and child) Repeat blood pressure, height, weight, and waist circumference measurements
- (Adult and child) Fitness assessment (step test)– same as the fitness assessment from baseline and 12 weeks visit
- (Adult and child) Run/walk 1 mile while being timed.
- (Adult only) complete a survey about your and your child's eating and physical activity habits
- (Adult and child) Activity trackers (Accelerometers) - You will be given an accelerometer that we will ask you and your child to wear for one week in order to measure physical activity

INCLUSIONARY and EXCLUSIONARY CRITERIA:
In order for you and your child to participate in this study, your child must be 6 to 11 years old. You both must be free of any mental or physical condition that limits your ability to move or restricts participation in sports, must not be taking medications that may influence hunger or body weight, and are not currently pregnant.

RISKS:
There is risk of being injured during the exercise sessions. The research team will reduce these risks by utilizing recommended exercise training procedures including having warm-up and cool-down activities, using appropriate facilities and equipment for the exercise sessions, increasing exercise intensity slowly throughout the program, and request that everyone wear appropriate clothing and shoes. Participants are screened prior to enrollment in this study to determine if it is safe for the participant to exercise. In some situations where exercise may not be safe, physician's approval is required.

It is possible that participants may feel uncomfortable answering survey or interview questions, during body measurements or during fitness assessments. You are able to stop during any procedures you are not comfortable with and can skip any survey or interview questions you do not wish to answer. Privacy screens will be used during body measurements to protect your privacy.

There is a risk of slight discomfort, bruising, swelling, dizziness, or you may faint as a result of the blood draw. Only trained research personnel will draw you and your child's blood and you both will be offered a snack after the blood draw. We will also apply numbing cream at the site of the draw for children. If at any time you or your child feel unable to complete the blood draw, you may ask to skip this measure.

There is a slight risk of discomfort when wearing the blood pressure cuff as it inflates. There is also a slight risk of discomfort to you or your child from doing the step-test.

There is a small risk associated with radiation exposure during the body composition measure (DEXA). However, the amount of radiation you and your child will be exposed to is approximately $1/10^{th}$ of the amount that you would be exposed to during an x-ray and less than you would experience on a flight across the Atlantic Ocean. All female participants who are menstruating will receive a pregnancy test before completing the DEXA to avoid any possible risks of radiation exposure to the fetus.

BENEFITS:
The possible benefits of your family's participation in the research include improving your and your child's fitness and improving dietary habits.

NEW INFORMATION:
You will be contacted if new information is discovered that would reasonably change your decision about you and your child's participation in this study.

CONFIDENTIALITY:
The results of the research study may be published but you and your child's name or identity will not be revealed. In order to maintain confidentiality, participants will be assigned a study identification number that will be used on all study records in place of participants' names. Study records with information about you will be kept locked in filing cabinets or on computers protected with passwords. Only those who work with this study will be allowed access to your information.

WITHDRAWAL PRIVILEGE:
There will be no penalty if you choose not to participate in this study. It will not affect you or your child's medical treatment, or future participation in the South Mountain Community Center's activities. Likewise, you and your child are free to drop from the study at any time for any reason and there will be no penalty.

COSTS AND PAYMENTS:
There is no cost to participants to join this study.
As compensation for your time and participation in this program, you or your child will receive:

- Lab visit: Your family will receive an incentive worth approximately $20 for participating in the laboratory visit (before the program and after the program at 12 weeks).
- Accelerometer: Your child will receive a toy worth approximately $5 for each time that they wear the accelerometer (before the program, 12, and 24 weeks).
- Following last visit before the program begins: A one-year City of Phoenix Park and Recreation Department Recreation Pass/membership card for you and your child. If you already have one, we will give you a voucher to renew your membership when yours expires.

- Home visits: You will receive an incentive worth approximately $10 for each home visit you participate in (before the program begins and after the program at week 12).
- Twelve week follow up: You will receive an incentive worth approximately $10 participating in the 24 week follow-up measurements

COMPENSATION FOR ILLNESS AND INJURY:
Agreeing to you and your child's participation does not waive any of your legal rights. However, no funds have been set aside to compensate you in the event of injury. In the event that you or your child suffers harm as a result of participation in this research project, you may contact Dr. Noe Crespo at (602) 827-2279 or you may contact the Chair of the Human Subjects Institutional Review Board through the Research Compliance Office at (480) 965-6788.

If, during the interviews, there is evidence that you or your child has extreme depression, other signs of mental illness, or even suicide; project staff would work with you to see that you or your child gets help. This might require that we inform other professionals if necessary to protect your safety.

Project staff will also report to appropriate professionals if there is evidence that any member of your family is in danger of being harmed by any other family member or of causing harm to themselves, another family member, or others. This includes evidence of possible suicide and abuse of minor children.

VOLUNTARY CONSENT
By signing this form, you are saying 1) that you have read this form or have had it read to you, and 2) that you are satisfied and you understand this form, the research study, and its risks and benefits. The researchers will be happy to answer any questions you have about the research. If you have any questions, please feel free to contact Dr. Noe Crespo at (602) 827-2279.

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, please call the Chair of the Human Subjects Institutional Review Board through the ASU Office of Research Integrity and Assurance at (480) 965-6788.

Note: By signing below, you are telling the researchers YES, that you agree to participate and give permission for your child to participate in this study. Please keep one copy of this form for your records.

_____
Your child's name (please print)

Parent: Your name (please print)	Parent Signature	Date

Your initials here indicate whether you consent to completing the **home visit**.

I ☐ *DO* consent to completing the home visit.

I ☐ *DO NOT* consent to completing the home visit.

_____
Parent's Initial's

Your initials here indicate whether your child would like to wear t**he additional activity monitor** during each of the data collection phases (0, 12, and 24 weeks)

I ☐ *DO* consent to have my child wear an additional activity monitor.

I ☐ *DO NOT* consent to have my child wear an additional activity monitor.

_____
Subjects Initial's

As a part of this program we would like to take pictures for use on our Facebook page, and presentations or publications describing the project. Your name and other contact information will not be associated with these pictures in any way.

Your initials here indicate whether you consent for the AFL research team to **take pictures of you and your children** while participating in the program.

I ☐ *DO* consent to the use of photographs of me and my family.

I ☐ *DO NOT* consent to the use of photographs of me and my family.

_____
Parent's Initial's

INVESTIGATOR'S STATEMENT:

I certify that this form includes all information concerning the study relevant to the protection of the rights of the participants, including the nature and purpose of this research, benefits and risks, costs, and any experimental procedures.

I have described the rights and protections afforded to human research participants and have done nothing to pressure, coerce, or falsely entice the parent to allowing this child to participate. I am available to answer the parent's questions and have encouraged him/her to ask additional questions at any time during the course of the study.

_____ _____

Investigator's Signature Date

APPENDIX C

IRB APPROVAL NOTICE

ASU Knowledge Enterprise Development

APPROVAL FULL BOARD

Noe Crespo
SNHP - Exercise and Wellness
602/827-2279
Noe.Crespo@asu.edu

Dear Noe Crespo:

On 8/1/2014 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Athletes for Life Phase 3: A family nutrition and physical activity intervention to improve fitness and prevent cardiovascular disease among elementary aged children and their parents.
Investigator:	Noe Crespo
IRB ID:	STUDY00001286
Funding:	Name: American Heart Association, National Center; Funding Source ID: 14SDG20490382,
Documents Reviewed:	• Appendix 12_Child Assent Form_English_072414_AC.pdf, Category: Consent Form; • Appendix 11_Parental Consent Form_English_073114_CLEANED.pdf, Category: Consent Form; • AHA_Bioscience application_FINAL_73114_AC.docx, Category: IRB Protocol; • Appendix 15- Child survey english+spanish.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Appendix 10-PAR-Q.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Appendix 14- Parent survey english+spanish.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Appendix 16-

	FINAL_AFL_MODIFIED HomeFoodInventory1_22_14.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Appendix 13- Anthropometric Measurements Protocol (ALBERTO FLOREZ's conflicted copy 2014-07-06).pdf, Category: Other (to reflect anything not captured above); • Appendix 5- Adult Physical Activity Curriculum outline.pdf, Category: Other (to reflect anything not captured above); • Appendix 6- Adult nutrition program outline.pdf, Category: Other (to reflect anything not captured above); • Appendix 1-Valentina_MPHC_Letter of Support_.pdf, Category: Other (to reflect anything not captured above); • Appendix 2-Frank_SMCC_Letter of Support_.pdf, Category: Other (to reflect anything not captured above); • Appendix 3- Child Nutrition Curriculum Outline_.docx, Category: Other (to reflect anything not captured above); • Appendix 4- Child Physical activity Curriculum Outline_.pdf, Category: Other (to reflect anything not captured above); • Appendix 7-AFL2_RECRUITMENT FLYER_.pdf, Category: Recruitment Materials; • Appendix 8-AFL2_INTEREST PARENT CONTACT INFO SHEET_.pdf, Category: Recruitment Materials; • Appendix 7-AFL2_RECRUITMENT FLYER_.pdf, Category: Recruitment materials/advertisements /verbal scripts/phone scripts; • Appendix 9- Athletes for life_Recruitment Script_070313.pdf, Category: Recruitment materials/Advertisements /verbal scripts/phone scripts; • Appendix 8-AFL2_INTEREST PARENT CONTACT INFO SHEET_.pdf, Category: Recruitment materials/Advertisements /verbal scripts/phone scripts; • Crespo_AHA_RMT30521120_award_letter.pdf, Category: Sponsor Attachment; • AHA Grant_Research Strategy_1-13-13.pdf, Category: Sponsor Attachment; • Appendix 18- Home Visit Protocol.pdf, Category: Technical materials/diagrams; • Appendix 17-backtranslation-form.pdf, Category: Translations;

The IRB approved the protocol from 7/23/2014 to 7/22/2015 inclusive. Before 7/22/2015, you are to submit a completed "FORM: Continuing Review (HRP-212)" and required attachments to request continuing approval or closure.

	FINAL_AFL_MODIFIED Home Food Inventory 1_22_14.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Appendix 13- Anthropometric Measurements Protocol (ALBERTO FLOREZ's conflicted copy 2014-07-06).pdf, Category: Other (to reflect anything not captured above); • Appendix 5- Adult Physical Activity Curriculum outline.pdf, Category: Other (to reflect anything not captured above); • Appendix 6- Adult nutrition program outline.pdf, Category: Other (to reflect anything not captured above); • Appendix 1-Valentina_MPHC_Letter of Support_.pdf, Category: Other (to reflect anything not captured above); • Appendix 2-Frank_SMCC_Letter of Support_.pdf, Category: Other (to reflect anything not captured above); • Appendix 3-Child Nutrition Curriculum Outline_.docx, Category: Other (to reflect anything not captured above); • Appendix 4-Child Physical activity Curriculum Outline_.pdf, Category: Other (to reflect anything not captured above); • Appendix 7-AFL2_RECRUITMENT FLYER_.pdf, Category: Recruitment Materials; • Appendix 8-AFL2_INTEREST PARENT CONTACT INFO SHEET_.pdf, Category: Recruitment Materials; • Appendix 7-AFL2_RECRUITMENT FLYER_.pdf, Category: Recruitment materials/advertisements /verbal scripts/phone scripts; • Appendix 9- Athletes for life_Recruitment Script_070313.pdf, Category: Recruitment materials/Advertisements /verbal scripts/phone scripts; • Appendix 8-AFL2_INTEREST PARENT CONTACT INFO SHEET_.pdf, Category: Recruitment materials/Advertisements /verbal scripts/phone scripts; • Crespo_AHA_RMT30521120_award_letter.pdf, Category: Sponsor Attachment; • AHA Grant_Research Strategy_1-13-13.pdf, Category: Sponsor Attachment; • Appendix 18- Home Visit Protocol.pdf, Category: Technical materials/diagrams; • Appendix 17-backtranslation-form.pdf, Category: Translations;

IRB approved the protocol from 7/23/2014 to 7/22/2015 inclusive. Before 7/22/2015, are to submit a completed "FORM: Continuing Review (HRP-212)" and required chments to request continuing approval or closure.

APPENDIX D

INTERVENTION FACILITATOR MANUAL

Athletes For Life

Active living, eating well, family values

Lifestyle Intervention
Facilitator Handbook

ASU School of Nutrition & Health Promotion
ARIZONA STATE UNIVERSITY

FUN PLACES GREAT SPACES
City of Phoenix
Parks and Recreation

Program Overview

Class	Topic
1	Introduction to Athletes for Life Program
2	Reaching Your Goals
3	Chronic Disease: Reducing Your Risk
4	Making Good Nutrition and PA a Way of Life
5	Basics of Nutrition
6	Fruits and Vegetables: The Power of Color
7	Reading Labels
8	Portion Control
9	Calories, Energy Needs, and Weight Loss
10	
11	The Power of Positivity
12	Controlling Blood Sugar
13	Controlling Blood Fats
14	Meal Planning and Grocery Shopping
15	Healthy Home Environment
16	Get Moving: Reducing Screen Time and Increasing Activity
17	Smart Snacking
18	Transforming Your Favorite Recipes
19	Damage Control: Avoiding holiday Weight Gain
20	Family, Friends, Food, and Fitness
21	Maintaining Change
22	Long Term Goals
23	Mindful Eating
24	Graduation Celebration

Session 1: Introduction to Athletes for Life

Overview:

The primary purpose of this session is to introduce participants to the goals of the program and to develop rapport and begin to build relationships between the Athletes for Life staff and participants and also between participants. We will serve black bean salsa in order to create an informal atmosphere for discussion.

- Introduce project staff and complete group introduction
- Give parents overview of program and its objectives
- Describe point system to parents

Equipment needed:

- Participant handbooks
- Writing utensils
- Name tags
- Top prize examples

Welcome:

- As participants walk in introduce yourself and shake their hand
- Give each participant a nametag and hand them their participant handbook
- At the scheduled start time of the session, begin the session

<u>Describing the intervention</u>

Script example:

"Welcome everyone and thank you for taking time out of your life to be a part of our exciting program. This program has been under continual development by researchers from Arizona State University's School of Nutrition and Health Promotion and Phoenix Parks and Recreation South Mountain Community Center. Our vision was to create a program that gives families the opportunity to engage in physical activity and learn about healthy habits in a fun supportive environment within their own community. Our goal for this program is to help you and your family reduce your long term risk of chronic diseases like diabetes, heart disease, and cancer. We will do this by helping you to improve your level of physical fitness, and improving your diet. Making a commitment to improving these two aspects of your lifestyle will help you to dramatically lower your risk of getting each of these common and devastating diseases. We hope that this program will help you to make that commitment/ to yourself and your family to make some lifestyle changes that will help you to avoid disease and live a healthy, happy life."

<u>Brief introduction to topics</u>

- Allow participants 5 minutes to review the list of intervention topics. Provide them with your name, phone #, and email address so they can contact if needed.

<u>Introductions and icebreaker:</u>

- Go around the room and ask each person to introduce themselves with the following:
    - Name

- Their PA and diet history and current practices (i.e. used to play sports but does not currently have time or accessibility to PA opportunities, has been a chronic dieter, etc)
- Their household characteristics (i.e. live with husband and three children)
- The reason that they signed up for this program

Participant expectations:
"We have put a great deal of time and effort into developing this program and offering it as a free program to families. Please respect us and your fellow group members by committing to the following guidelines."

- Do not repeat any personal information shared by another group member outside of this group
- Be on time to EVERY session
- Do not text or talk on telephone during session. If you need to take a phone call please step outside.
- Participate. Share your ideas and experiences.
- Do not interrupt other participants.
- Listen to others when they speak and respect their feelings and opinions.
- Come in with a positive attitude.
- Complete the weekly challenges that we give you

Action: Have participants sign the Commitment Forms in their handbook. Allow them to keep the forms.

Motivation Page:
"Throughout this 12-week program, we would like for you to try to keep in mind, why you signed up for this program. When trying to make a significant change in your life there are two things that you need to focus on: What you need to do and why you are doing it. Throughout this program we will help you to figure out the what. For this page, we want you to write down the why."
[Give participants 10 minutes to fill out their motivation page, while allowing them to

Describing the point system:
Script example:
"As a part of this program we will be implementing a point system. You will receive 5 points for attendance at each class, 5 points for bringing in your completed tracking sheets each week. We will describe these tracking sheets next session and will ask you to turn them in weekly. We will also offer points for completing other challenges over the course of this program. At the end of the program we will be giving prizes, and the value of the prize you will receive will be based on your accumulated points."
[HAVE EXAMPLES OF TOP PRIZES IN THE ROOM AT THE SESSION]

Conclusion and dismissal:
Script example:

"Again, thank you all for signing up for this program and making the effort to improve the health and lives of your families. We look forward to these 12 weeks and we hope to see several positive transformations."

Session 2: Reaching Your Goals

Overview:
The primary purpose of this session is to introduce participants to SMART goal setting and teach them how to set goals and monitor their progress in achieving their goals.

- Discuss goal setting and the concept of SMART goal setting
- Introduce and discuss the participant tracking sheets
- Work with participants to set goals for PA, FV intake, and sugar food consumption
-

Equipment needed:

- Tracking logs
- Writing utensils
- Name tags
- Tracking sheets

Welcome:

- As participants walk in introduce yourself and shake their hand
- Give each participant a nametag and hand them their participant handbook
- At the scheduled start time of the session, begin the session

Goal Setting:
Script Example-
"If you want to do make changes in your lifestyle, but you don't set goals and monitor them well, you are more than likely going to fail. Trying to make a lifestyle change without setting SMART goals before you start is like traveling to a destination and hoping to get there without having the specific address. At best you are going to arrive at the destination later than you would have liked. First you set a goal and you identify the specific destination that you would like to arrive at, and then you need to get directions, which are the plans that you intend to carry out in pursuit of your goal. If you set a goal well and develop a plan well, the only other factor that needs to take place is execution."
Give participants time to fill out their program goal.
Action: Hand out tracking sheets log.
Describing the tracking sheets:
Script example
"One of the most powerful tools that can help you make some lifestyle changes is tracking those changes. We have handed out tracking sheets which we would like for you to use to track your physical activity, fruit and vegetable intake, and sugary food intake. We have provided you with examples of how each of these sheets should be filled out. "
-Physical Activity
"In the physical activity tracking sheets, we want you to write down any activity that you are doing beyond what you do normally. We want you to write down things that cause your heart rate and breathing to go up during and immediately after performing the activity. Examples are walked 10 flights of stairs at work, went for a walk with my

family, went hiking, went swimming, went dancing, did Zumba, did exercise video, etc. We want you to only write down things that you did to be physically active beyond your normal activities. Don't write things like went grocery shopping, or washed the dishes in here. Although these are physical activities, we are more interested in things that you are intentionally doing to get extra physical activity.

-Fruits and vegetables

"We will also ask you to track the number of fruits and vegetables that you eat. For this you will have to estimate serving sizes of fruits and vegetables. We will discuss this in further detail later on in the program, but for now we will follow these simple rules. A serving of fruit or raw vegetable is approximately 1 cup, which is about the size of a fist or a baseball. A serving of cooked vegetables is half a cup or about an open palmful. It is important to be consistent in your fruit and vegetable serving size estimations."

-Sugary Foods

"The last thing that we will ask you to track is your consumption of sugary foods. We define sugary foods as any food or drink item that has more than 10 g of sugar per servings. This will include cereal, some granola bars, chocolate, and most pastry items. Estimating the size of portion of sugary foods, can be difficult but we have provided you with a guide to help you to estimate how many portions of sugary foods that you are eating.

Prompt questions and further explain the serving sizes of different fruits and vegetables

Instructor:

Tell parents that we would like for them to complete these sheets each week and return them. Each Thursday we will pick up tracking sheets and families will earn five points for the parent completing the sheet.

Weekly Challenge:

To earn five points for your challenge this week, we ask you to decorate your binder with a few things that motivated you to sign up for this program. It could be pictures of your family, pictures of yourself when you were younger, or anything else that would help you to remember what motivates you. Ask your children to help you out with this. Bring a decorated binder in on Monday and show it to the research assistants at check in to earn one extra sticker.

Conclusion:

Conclude the session and thank the participants for coming.

Session 3: Chronic Disease: Reducing your risk

Overview:
The primary purpose of this session is to define and describe the epidemic of chronic disease in the United States and to establish a connection between chronic disease and behavioral risk factors.

- Define chronic disease
- Provide statistics for prevalence of chronic diseases
- Explain the cardiovascular system and how physical activity and eating a healthy diet can improve the function if the CVD system
- Complete the what's your risk activity
- Provide brief nutrition and activity recommendations

Equipment needed:

- Session 3 materials
- Writing utensils
- Name tags
- Items for making smoothies

Welcome:

- As participants walk in introduce yourself and shake their hand
- Give each participant a nametag and hand them their participant handbook
- At the scheduled start time of the session, begin the session

Activity: Green Berry Smoothie

- Start the session by demonstrating how to make a green berry smoothie

Chronic Disease:

- Define chronic disease- A disease or condition that persists for a long period of time
- Describe rates of chronic disease in the United States
- Give examples of different chronic diseases and ask participants if they know anyone who has any of these conditions
    - Prompt participants to describe personal experiences with any of these conditions.

Lifestyle and Type 2 Diabetes:

- Explain the study published by Hu et al. in 2001 that demonstrated the substantial reduction in risk of type 2 diabetes for those who lived a healthier lifestyle.
- Re-iterate the fact that ALMOST all cases of type 2 diabetes could be prevented by living a healthy lifestyle.

Lifestyle and your cardiorespiratory system:

- Introduce the function of the cardiovascular and respiratory systems and explain the role that these systems play in maintaining a healthy body and avoiding chronic disease
- Explain how exercise and a healthy diet can improve the function of the cardiorespiratory system and prevent disease.

Activity: What is your risk?

- Have participants stand on one side of the room lined up shoulder to shoulder facing the group facilitator.
- Begin calling off each of the risk factors listed in the "Whats your Risk?" worksheet in the participant handbook.
- Instruct participants to step forward for each negative risk factor and take a step back for each positive risk factor.

Final Recommendations:

- Go over the nutrition and physical activity recommendations listed in the participant handbook
- Allow participants to ask any questions and inquire further

Conclusion:

- Conclude the session and thank the participants for coming.

Session 4: Lifestyle Habits: Making Good Nutrition and Physical Activity a Way of Life

Overview:
The primary purpose of this session is to emphasize that healthy eating and physical activity are habits that can be maintained easily throughout the lifespan rather than something that you do for a short period of time to lose some weight. The second half of the session will focus on exercise and the goal is to get everyone to commit to start working on developing some exercise habits.

- Define habit
- Discuss changing habits
- Introduce the concept of tiny steps
- Discuss applying the tiny steps concept to exercise
- Review health consequences of physical inactivity diagram
- Discuss inspiring others and motivation
- Issue and explain weekly challenge

Equipment needed:

- Session 4 materials
- Writing utensils
- Name tags

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Defining habits:</u>

- Discuss the definition of habit provided in the participant workbook
- Emphasize the following. A habit is:
    - Repeated regularly
    - Becomes automatic

<u>Changing habits:</u>

- Reinforce the notion that changing habits is a process that takes time and effort and not something that happens overnight
- Assure the participants that the initial steps are the hardest part. Once behaviors start to take on the characteristics of a habit, they become easier and more automatic

<u>Tiny Steps and Progress:</u>

- Encourage participants to break up their goals into smaller steps that they can accomplish each day

- Make sure that participants are focusing on progress and their small success. Ask them to focus on small daily and weekly goals and work their way up to their greater long term goals.

Exercise

- Ask participants to make an effort to program one bout of physical activity that lasts at least 15 minute into their daily routine.
- Discuss why it is important for the participants to challenge themselves with exercise
- Issue exercise goals for the program
- Review the diagram in the page with the heading "Why exercising isn't an option". These are the health consequences of physical inactivity. The benefits of physical activity are just the opposite.

Inspiring Others and Motivation

- Discuss the power of making lifestyle changes and being dedicated and persistent on friends, family, and co-workers
- Ask participants to continually re-examine their motivation and goals throughout the program and beyond to continue to stay motivated.

Issue challenge:

- Hand out pedometers to each participant
- Ask them to wear the pedometer and log the number of steps that they take each day for the week
- The challenge is to accumulate 70,000 steps over the next week
- Explain that 10,000 steps a day is the recommended number of steps that reflects an active lifestyle

Conclusion:

- Conclude the session and thank the participants for coming.

Session 5: Basics of Nutrition

Overview:
The primary purpose of this session is to present participants with the foundational knowledge to distinguish between foods and dietary patterns that will improve their health and those that will negatively impact their health. Provide several examples of the foods and dietary patterns that will promote long-term health.

- Discuss participant progress on current goals and challenges
- Discuss the purpose of nutrition
- Describe the basics of nutrition and what to eat
- Give examples of green, yellow and red foods
- Give examples of green, yellow, and red, homes
- Closing points for transitioning diet towards more "green" health promoting diet

Equipment needed:

- Session 4 materials
- Writing utensils
- Name tags

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Discussing progress on current goals and challenges:</u>

- Ask participants how they are doing in meeting their goals that they set during week 1
- Discuss how participants are doing with meeting their step challenge
    - Identify any barriers that may come up and try to help participants problem solve to overcome these barriers
    - Reinforce any successes that have been made

<u>The purpose of nutrition:</u>

- Describe the two primary functions of food: Repair and energy
- Describe how the human body continuously regenerates itself
    - Describe how good nutrition provides a strong foundation of building blocks to build new organs and tissues
- Describe how the human body is continuously dependent upon an energy supply
    - Explain the difference between nutritious foods and less nutritive foods with regard to the types of energy that they supple (fast vs. slow; see participant handbook)

<u>What to eat:</u>

- Review the list of green, yellow, and red foods with the participants
- Present guidelines for the consumption of foods from each of these categories

Examples of green, yellow, and red foods

- Have participants break into groups and review the examples of green, yellow, and red foods.
    - Describe the characteristics of each of these food categories and answer any questions that are posed

Examples of green, yellow, and red homes

- With participants still in their groups have them review the examples of green, yellow, and red home food environments
    - Describe the characteristics of each of these home environments (see participant handbook) and answer any questions that are posed

Final Points:

- Describe the difference between food and "food products" (see participant handbook)
- Explain the importance of removing red foods from the home before trying to transition towards more green foods
- Re-emphasize the importance of participants making the commitment to change their dietary habits.

Conclusion:

- Conclude the session and thank the participants for coming.

Session 6: Fruits and Vegetables: The Power of Color

Overview:

The primary goal of this session is to expose participants to the specific and powerful health benefits that can be achieved by eating a diet rich in various colors of fruits and vegetables. Second, we will have a prepared snack (Nutrient Dense Black Bean Salad) and break into groups and practice creating one nutrient dense recipe that will be shared with the rest of the group.

- Discuss participant progress on current goals and challenges
- Introduce the concept of food as medicine
- Describe the health benefits of different colored plant foods
- Define nutrient density
- Discuss the nutrient density scores of fruits and vegetables
- Discuss the additional benefits that herbs and spices can add to food
- Have snack
- Create a recipe in group

Equipment needed:

- Session 6 materials
- Writing utensils
- Name tags
- Nutrient Dense Black Bean Salad (see recipe book)

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Discussing progress on current goals and challenges:</u>

- Ask participants how they are doing in meeting their goals that they set during week 1
- Discuss how participants are doing with meeting their step challenge
    - Identify any barriers that may come up and try to help participants problem solve to overcome these barriers
    - Reinforce any successes that have been made

<u>Food as medicine:</u>

- Present and discuss the Hippocrates quote “Let Food be Thy Medicine”.
- Define phytonutrients
- Explain why plants food are most beneficial to health

<u>The power of color:</u>

- Review the table of the health benefits of each color of fruits and vegetables, examples of those foods, and the health benefits.

- Emphasize to participants that they should be eating foods from each color group regularly

Nutrient density:

- Define nutrient density
- Review the nutrient density chart with participants
    - Highlight the items with high nutrient density scores and encourage participants to eat as much as they can of these items.

Maximizing health benefits of food:

- Emphasize the importance of using herbs in spices to add flavor and to replace salt-based seasonings
- Have participants identify with their role as their family's pharmacist.

Snack:

- Pass out the Nutrient Dense Black Bean Salad in small servings.
- Ask participants to identify the beneficial ingredients

Activity: Creating medicinal recipe

- Break participants into groups of 2-3 and have them create one tasty nutrient dense recipe
- Have other participants choose the group with the most appealing recipe and that group will get another sticker to add to their point tracker

Conclusion:

- Conclude the session and thank the participants for coming.

Session 7: Reading Labels

Overview:
The primary goal of this session is to introduce participants to guidelines for choosing packaged foods based on their labels. We will present guidelines for several nutrients and ingredients that we would like participants to follow. Most importantly we will emphasize the notion that most food should not come from packages.

- Emphasize the need for reading labels
- Highlight the fact that most foods should not come from packages
- Review the components of a nutrition panel and offer guidelines for participants to follow
- Offer rules and guidelines for selecting foods based on the ingredients list
- Re-evaluate goal that were set during week 1 and set new program goals

Equipment needed:

- Session 7 materials
- Writing utensils
- Name tags

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Discussing progress on current goals and challenges:</u>

- Ask participants how they are doing in meeting their goals that they set during week 1
- Discuss how participants are doing with meeting their step challenge
    - Identify any barriers that may come up and try to help participants problem solve to overcome these barriers
    - Reinforce any successes that have been made

<u>Reading Labels-Introduction:</u>

- Emphasize that most food should not come in packages and, therefore, will not have labels
- Highlight how important it is to read labels when buying packaged foods

<u>Nutrition Panel:</u>

- Review the parts of the nutrition panel and the guidelines presented in the participant handbook with the participants.

<u>Ingredients:</u>

- Review the guidelines for which ingredients to avoid given in the participant handbook

<u>Re-Assessing Goals:</u>

- Ask participants to go back to the goals that they set for themselves during the first week of the program.
    - Ask them how they are doing?
- Now prompt them to go back and set new goals based on their current progress and experience with trying to make lifestyle changes.
- the group with the most appealing recipe and that group will get another sticker to add to their point tracker

Conclusion:

- Conclude the session and thank the participants for coming.

Session 8: Portion Control

Overview:
The primary goal of this session is to give participants a concept of many commonly consumed foods that contribute a significant amount of calories to the diet. We will have a brief discussion on portion control and then move on to an activity where participants will practice estimating portions and then test their estimations by either weighing the food, or measuring with measuring supplies.

- Discuss the importance of being able to identify portion sizes
- Review the hand symbol portion size guide
- Introduce the concept of energy density and review the two examples
- Activity: Estimating portions and calorie content

Equipment needed:

- Session 8 materials
- Writing utensils
- Name tags
- Food for demonstration
    - Beans
    - Beef
    - Chicken
    - Cheese
    - Rice
    - Pasta
    - Almonds
    - Olive oil
    - Avocado

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Discussing progress on current goals and challenges:</u>

- Ask participants how they are doing in meeting their goals that they set during week 1
- Discuss how participants are doing with meeting their step challenge
    - Identify any barriers that may come up and try to help participants problem solve to overcome these barriers
    - Reinforce any successes that have been made

Activity: Estimating portion sizes and calorie contents

- Set up stations around the room with the following themes
    - Carbohydrates (pasta and rice)
    - Fats (olive oil, almonds, avocado)
    - Protein (chicken and beef)
    - Beans
    - Cheese
    - Liquid
- Allow participants to go around the room and try to estimate the amount of food that makes up a portion of each of the example foods
- Once they have made an estimate, allow them to come to the validation table, where they will be able to check their accuracy of estimation
- Rotate stations until participants have gotten through all of the stations

Portion control-materials:

- Emphasize the importance of being aware of your portion sizes

Hand symbols for serving sizes:

- Review the hand symbols and serving size table located in the participant handbook.

Energy Density:

- Introduce the concept of energy density and review the examples

Conclusion:

- Conclude the session and thank the participants for coming.

Session 9 and 10: Calories, Energy, Weight loss, and Health

Overview:
The purpose of this session is to teach participants the relative importance of behaviors in relation to body weight on their health. We also want to emphasize the importance of eating low energy dense foods in order to effortlessly reduce the amount of calories consumed. We will begin this lesson with an activity, and then move onto the lesson.

- Begin with a timed 1 mile run.
- Once participants have completed the mile, bring them into the session room where they will be preparing food
- Spend 30 minutes preparing spaghetti and parfaits
- Use the remaining 30 minutes to discuss the lesson

Equipment needed:

- Week 5 materials
- Writing utensils
- Name tags
- Food for demonstration
    - Veggie pasta ingredients
    - Parfait ingredients
- Kitchen supplies
    - Skillet
    - Large mixing bowl
    - Large serving spoons
    - Paper plates
    - Small plastic cups
    - Spoons and forks
    - Tupperware

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Timed Mile:</u>

- Guide participants through a structured warm-up that includes walking along with some lower body stretches
- Give participants their times that they received for the 1 mile run at baseline
- Have participants start in groups and run twice around the track while being timed
- Reinforce effort in completing the mile in a timely manner

<u>Activity: Italian Dinner and parfait dessert</u>

- Bring in the following for the preparation of Italian dinner

    - Two cups of chopped onion (2 medium onions)
    - 3 cups of chopped bell pepper (2 medium bell peppers)
    - 2 cups of chopped zucchini (1 large zucchini)
    - 7 cups of chopped spinach
    - 4 cloves of minced garlic
    - 2 tablespoons of chopped basil
    - 4 tablespoons of olive oil
    - 1 pound of ground turkey (extra lean)*
    - 1 package (16 ounces) of whole wheat pasta*

*Pre-cook these ingredients

- Bring in the following for the preparation of the parfait dessert
    - 3 pounds of mixed berries
    - 2 boxes of whole grain cereal
    - Vanilla extract
    - Cinnamon
    - Four 32 ounce containers of plain fat free yogurt

- Assist participants in preparing these dishes. Make sure that you ask participants to estimate calories contained in each meal as they are moving along. For all of the vegetables and non-packaged items, place labels indicating the caloric value of the food.
- When the food has been made serve equal portions out to each of the participants and move onto the lesson

<u>Lesson: Calories, energy needs, and weight loss</u>

- Describe calories as energy concept
- Describe energy balance, and the energy needs of children
- Help participants to classify their caloric intakes
- Explain why reducing caloric intake is the most important weight loss strategy
- Describe the concept of energy density and why it is important in weight loss
    - Review examples
- Introduce parents to supertracker from the USDA.

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 11: The Power of Positivity

Overview:
The purpose of this session is to: 1) explain the importance of creating a positive mental attitude, particularly with respect to goals and nutrition and physical activity behaviors; 2) give strategies for creating a positive self-conversation.

- Introduce the concept of the internal dialogue and how it dictates behaviors
- Explain how positivity can change the course and direction of a person's life
- Help the participants learn to reframe their thinking about their bodies to reflect a more positive thought process
- Go over 7 keys to creating positive thinking patterns
- Instruct participants to complete the positivity exercise on their own pace.

Equipment needed:

- Week 5 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Review of goals</u>

- Spend about 15 minutes at the beginning of the session reviewing each of the participants individual goals
- Give each participant time to discuss their progress and what they would like to achieve throughout the remainder of the program.

<u>Positivity is the key</u>

- Introduce the concept of the internal dialogue
- Explain how this dialogues dictates behaviors
- Connect these factors with health and wellness
- Explain how positive thinking can help to reframe problems and situations in such a way that change and progress can become easier
- Go over the example in the participant notebook about how you can reframe thinking our bodies to appreciate all of the many amazing processed that they engage in daily

<u>7 Ways to Becoming More Positive</u>

- Review each of the seven strategies for becoming creating a positive thought process located in the participant handbook and give examples of each

<u>Positivity Exercise</u>

- Instruct participants to complete the positivity exercise located in the participant handbook on their own time

Session 12: Controlling Blood Sugar

Overview: The purpose of this session explain why blood sugar control is important and to present strategies for keeping blood sugar in normal levels.

- Define glucotoxicity
- Connect blood sugar control and health
- Explain the difference in the blood sugar response to quickly and slowly digested carbohydrates
- Review the different groups of carbohydrates and their effect on blood sugar
- Present information about physical activity and blood sugar control.

Equipment needed:

- Session 12
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Sugar in the Blood</u>

- Define and explain glucotoxicity using the information from the participant manual. Make sure and mention that high glucose:
    - Damages tissues
    - Increases the thickness of the blood
    - Contributes to the development of most chronic diseases
- Describe blood sugar response and the role of carbohydrate digestion speed in fluctuations in blood glucose

<u>Diet and Blood Sugar</u>

- Explain how dietary habits contribute to blood sugar fluctuations
- Explain the role of fiber in blunting the blood glucose response
- Review the visual in the participant handbook that classifies carbohydrate containing food groups based on the blood glucose responses that they elicit.

<u>Physical Activity and Blood Sugar</u>

- Describe how muscle is the primary disposal site for blood glucose
- Explain how exercise intensity and duration can contribute to glycogen depletion and blood glucose control

<u>Final Thoughts</u>

- Explain that avoiding refined carbohydrates and sugars and regular intense exercise are the most effective ways of regulating blood sugars.

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 13: Controlling Blood Fats

Overview:
The purpose of this session is to explain why blood fat control is important and to present strategies for keeping blood fats in normal levels.

- Define cholesterol, LDL, HDL, and triglycerides
- Describe how the immune system can contribute to plaque development
- Discuss heart disease as the leading cause of death in the world
- Review the different contributors to heart disease risk
- Review recommendations for heart disease risk reduction
- Present "daily dose" challenge in the located in the participant handbook

Equipment needed:

- Session 13 materials
- Writing utensils

Welcome:

-
- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Introduction to blood fats</u>

- Define cholesterol
- Define LDL cholesterol
- Define HDL cholesterol
- Define triglycerides
- Discuss how the immune system contributes to plaque development

<u>Lifestyle and Heart Disease</u>

- Present heart disease as the leading cause of death in the world
- Explain how smoking contributes to heart disease risk
- Explain how dietary habits contributes to heart disease risk
- Explain how physical activity contributes to heart disease risk
- Explain how stress contributes to heart disease risk
- Explain how environmental toxins contribute to heart disease risk

<u>Heart Disease Risk Reduction</u>

- Review the recommendations for heart disease risk reduction
- Introduce "The Daily Dose" challenge and instruct participants to complete the daily dose table located in the participant handbook and to return the completed table next week.

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 14: Meal Planning and Grocery Shopping

Overview: The purpose of this session is to have participants go through the exercise of planning their meals and creating a grocery list based on the planned meals.

- Emphasize the importance of planning
- Explain why the decisions that they make at the grocery store should be the most critical decisions that they make when it comes dietary habits.
- Guide participants in creating a grocery list for the upcoming seek that includes meals and snacks
- Guide participants in creating a grocery list based on the meals and snacks in the meal planner

Equipment needed:

- Session 14 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Planning and the grocery store</u>

- Review the Benjamin Franklin quote with the participants and have a short discussion about the importance of making plans
- Explain why a well-planned and executed grocery store visit could be their best tool for maintaining a healthy diet

<u>Developing a meal plan</u>

- Guide participants in developing a simple meal plan that meets all of our recommendations and fits within their time, and budget.
    - Ask participants to estimate the calories in each of their planned meals.
    - Make sure that each participant factors in all of the potential issues and barriers that would make sticking to the meal plan more difficult.

<u>Creating a shopping list</u>

- Help participants to turn their meal plan into a shopping list
    - Make sure that participants are writing down everything that they need
    - Make sure the participants are considering budget and where they can get the items

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 15: Environmental Restructuring: Making the Healthy Choice the Easy Choice

Overview:
The purpose of this session is to first describe the importance of the environment that a person lives and works in on their habits and choices about nutrition and physical activity. The second part of the session will give participants tips and strategies for restructuring environmental settings to promote better nutrition and provide opportunities for physical activity.

- Emphasize how powerful the environment can be for shaping behaviors.
- Review a list of questions that allow participants to reflect on their environment as it relates to nutrition and PA.
- Give tips for improving the home food environment.
- Give tips for creating opportunities for PA.

Equipment needed:

- Session 16 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Influence of the Environment</u>

- Define environment using the definition in the participant workbook
- Describe how important it is to create an environment that will help to push participants towards healthier lifestyle habits
- Explain why it is much easier to create a healthy environment than to try to make healthy choices in an environment that does not promote healthy choices

<u>Partner Activity: What is Your Environment Promoting?</u>

- Ask participants to form groups of 2-3 and discuss the questions located on page 2 of the week 16 participant materials.

<u>Restructuring Your Home Food Environment</u>

- Review the Healthy Home Environment DO's and DON'T on page 3 of the participant handbook
    - Ask participants for suggestions of things to add to the lists.

<u>Creating Opportunities for Physical Activity</u>

- Review the list of creating opportunities for physical activity located on page 4 of the participant handbook.
    - Ask participants for suggestions of things to add to the list.

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 16: Get Moving: Reducing Screen Time, Increasing Activity

Overview: The purpose of this session is to motivate participants to engage in more physical activity and spend less time sitting and watching television.

- Discuss television watching in the United States
- Describe reasons why watching television can be detrimental
- Plan physical activities for the week

Equipment needed:

- Session 16 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

Television watching in the United States

- Describe the average screen watching time in the United States
- Compare that to class time that is required to obtain a college degree

Top Five Reasons why Television is Harmful to Health

- Describe why the following factors related to television are harmful to health
    - Sedentary
    - Eating while watching television
    - Not educational
    - Advertising
    - Creates unrealistic expectations

Programming PA for the week

- Have participants plan their PA for each day during the upcoming week. Help them to plan physical activities that can be enjoyable that fit into their schedules

Conclusion:

- Conclude the session and thank the participants for coming.

Session 17: Smart Snacking

Overview:
The purpose of this session is to discuss how to snack healthier. We will present some guidelines for a healthy snack and then provide several examples of things that can be eaten as a healthy snack. Last we will present the participants with a recipe for hummus and we will allow them to sample different snack options that we have brought in.

- Discuss the importance of choosing snacks wisely
- Describe a timeline for meals and snacks
- Present guidelines for smart snacking
- Review smart snacking options
- Discuss hummus recipe and have participants try snack options including hummus and vegetables

Equipment needed:

- Session 17 materials
- Writing utensils
- Snack
    - Hummus (and other approved dips
    - Vegetables
        - Carrots
        - Broccoli
        - Cauliflower
        - Celery

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Progress Review</u>

- Review participants progress on their daily PA planning sheets. Help participants to problem solve and overcome any barriers that anyone may have run into thus far.

<u>Smart Snacking</u>

- Describe why it is important to strategically choose and time snacks
- Present sample meal and snack plan

<u>Guidelines and options for smart snacking</u>

- Present guidelines for smart snacking. Answer any questions that participants have about these guidelines
    - 150-250 calories
    - > 5 g protein
    - 10:1 carbohydrate:fiber ratio

    - <10 g sugar (if not fruit)
    - Include fruit or vegetable
- Smart Snacking Options
    - Present smart snacking options with participants. Ask them to share any suggestions that they might have as well
- Present and discuss hummus recipe
- Have participants along with their children taste the snacks that were brought in

Conclusion:

- Conclude the session and thank the participants for coming.

Session 18: Transforming Your Favorite Recipes

Overview:
The purpose of this session is to discuss how to transform traditional recipes to make them more healthful. We will first discuss why food is such an important part of our culture and who we are and then we will present guidelines for transforming recipes. Last we will practice transforming a favorite Thanksgiving recipe.

- Discuss the importance of food and culture
- Present guidelines for transforming meals
- Discuss holiday weight gain
- Practice transforming Thanksgiving recipes.

Equipment needed:

- Session 18 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

<u>Progress Review</u>

- Review participants progress on their daily PA planning sheets. How did everyone do?

<u>Food and Culture</u>

- Describe why food is such an important part of who we are
- Describe the importance of maintaining the cultural connection to healthy food
- Discuss establishing a culture of good health

<u>Meal Transformation Guidelines</u>

- Review the 10 guidelines for meal transformations
    - Ask the group for one example of their favorite foods
    - Use this example and transform the recipe in order to reduce calories and increase nutrition

<u>Transforming Thanksgiving</u>

- Discuss how weight gain during the holidays is contributing to obesity epidemic
- Encourage participants to stay strong and to not overdo it during this time
- Ask each participant to choose their favorite Thanksgiving food and think about how they can transform that food to make it healthier
    - Ask participants to bring that food in next Monday. Participants who bring a dish in will receive three extra stickers on their attendance points.

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 19: Damage Control: Avoiding Holiday Weight Gain

Overview:
The purpose of this session is to discuss how to minimize the damage that overeating has on our bodies during the holiday season.

- Discuss holiday weight gain
- Define caloric restriction
- Explain caloric restriction
- Give an example of a very low calorie day
- Allow participants to plan their calorically restricted day

Equipment needed:

- Session 19 materials
- Writing utensils
- Sweet potato mac and cheese
- Sweet potatoes for participants

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session
- Review participants progress on their daily PA planning sheets. How did everyone do?

<u>Thanksgiving Potluck</u>

- Have participants who brought in healthy Thanksgiving options share their dish and recipes

<u>The Holiday Season</u>

- Describe holiday weight gain
- Discuss how most people gain the weight in a very short period of time

<u>Caloric Restriction</u>

- Define caloric restriction
- Give example of Thanksgiving caloric excess (see participant handbook)
- Describe how to counteract that excess with restriction
- Give example of 1,250 calorie day (see participant handbook)

<u>Practice Daily Plan</u>

- Allow participants to practice creating a calorie restricted meal plan

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 20: Family, Friends, Food, and Fitness

Overview:
The purpose of this session is to highlight the importance of friends and family in engaging in a healthy lifestyle. We will explain the different ways that friends and family can be leveraged to support behavior change and participants will be asked to find an "accountability partner" that will help them on their journey towards a healthier lifestyle.
Equipment needed:

- Session 20 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

Family and Friends: Are They Helping or Hurting?

- Describe the importance of social support in making and maintaining behavior changes.
- Ask participants to consider their social circles and discuss with how their social connections influence their behaviors.
    - Is it a positive or negative influence?
    - Prompt participants to consider how they make their social setting more positive.

Accountability Partner

- Describe the concept of an accountability partner
- Ask participants if any of them have someone they would consider an accountability partner
- Prompt participants to think about who they can call upon to be their accountability partner
    - Sister?
    - Husband?
    - Children?
    - Friend?
    - Co-worker?
    - Other participants?
- Ask participants to spend the remainder of the class time contacting their potential accountability partner to discuss the arrangement and the expectations of each individual.
- Prompt them to use each other as accountability partners.

Conclusion:

- Conclude the session and thank the participants for coming.

Session 21: Maintaining Change

Overview:
The purpose of this session is to discuss important components of long term behavior change maintenance. We will start by asking parents to reflect on their progress with respect to eating and physical activity that they have made since the start of the program and then transition to discussing how to maintain those changes and continue to improve habits.
Equipment needed:

- Session 21 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session
- Review participants progress on their daily PA planning sheets. How did everyone do?

<u>Current Progress Review</u>

- Spend some time asking each participant to name at least one specific thing that they are doing now different than before starting the program. Allow participants to elaborate and prompt them to discuss their progress thus far in as much depth as they feel comfortable disclosing.

<u>Maintaining a Healthy Lifestyle: The Big 5</u>

- Describe that there are some important factors that play a strong role in helping you to maintain long term behavior change. Discuss the following with the participants
    - Spending time with others who lead healthful lives
    - Track your progress
    - Refer back to your motivations
    - Control your environment
    - Stay positive

<u>Conclusion:</u>

- Conclude the session and thank the participants for coming.

Session 22: Long Term Goals

Overview:
The purpose of this session is to discuss long term goals of the program. We will explain why it is important to maintain long-term goals and to continually refer back to them and we will ask parents to track their progress on our main outcome measures.
Equipment needed:

- Session 21 materials
- Writing utensils

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session
- Review participants progress on their daily PA planning sheets. How did everyone do?

Long Term Goals

- Describe the difficulty in making and maintaining long-term changes in behavior
- Explain how long term behavior change comes with the development of habits
- Explain why it is important to maintain long-term goals and continue to work towards them

Long Term Goals-Recommendations

- Present recommendations for long-term goals
    - Eat at least 7 servings of fruits and vegetables daily
    - Get at least 30 minutes of physical activity daily
    - Twice weekly do some type of exercise to improve fitness for at least 20 minutes
    - Consume no more than 1 serving of sugary foods daily
    - Reduce television time to no more than 1 hour/day

Long Term Goal Recommendation Tracking Sheet

- Describe how to fill out the long term goal recommendation tracking sheet
- Answer any questions participants have regarding filling out these tracking sheets

Conclusion:

- Conclude the session and thank the participants for coming.

Session 23: Mindful Eating

Overview:
The purpose of this session is to the concept of mindful eating and engage in a mindful eating exercise. We will explain what mindful eating is and why it can be an important tool to maintaining a healthy lifestyle. Then we will do a short mindful eating exercise.
Equipment needed:

- Session 21 materials
- Writing utensils
- Snack: Oreo

Welcome:

- Welcome participants as they walk in
- At the scheduled start time of the session, begin the session

Mindful Eating Overview

- Explain the concept of mindfulness and solicit participant feedback regarding their own definition of what they think it is
- Describe how mindfulness can get lost in our busy lives
- Explain why mindfulness in eating can be important for avoiding weight gain

Mindful eating exercise

- Pass out one oreo cookie to each participant
- Ask them to eat this oreo however they see fit with only two rules
    - They spend at least 2 minutes tasting the oreo before they swallow it
    - They pay specific attention and make a mental note of what they think of the taste, texture, sight, and smell of the cookie
- After the exercise is complete ask participants to give their feedback about what they thought about the experience.

Conclusion:

- Conclude the session and thank the participants for coming.

Session 24: Graduation

Overview:
This session will consist of an unstructured group discussion with the purpose of getting participant feedback about the program, but also to help answer any remaining questions.

- Participants are encouraged to bring a healthy snack to share with the group.

APPENDIX E

PARTICIPANT SURVEY

Athletes For Life Family Survey	Date: ___/___/_____
Family ID: _____	Interviewer ID:_____

We need your help to make our study a success. Your honest answers to the questions in this survey are very important to us. This survey will take approximately 45 minutes to complete. Remember…

- We want to know what you think
- Try to answer all the questions
- There are no right or wrong answers

The first section of questions is about you and the second section is about your child who is participating in the program with you.

All of your responses are kept strictly confidential—we will not share any personal information with anyone outside the study.

Now we will ask you some questions about you, remember everything is kept confidential.

1 What is your date of birth? (MM/DD/YYYY)

_____

2 Are you...?

O Female

O Male

3 What is your marital status?

O Single

O Married, living with spouse

O Married, not living with spouse

O Living together, but not legally married (free union)

O Separated

O Divorced

O Widowed

O Don't know

O Refuse

4 How many people live in your household including yourself?

- O Children _____
- O Adults _____

5 Which of the following describes your employment? (Check all that apply)

- O Employed full-time, 35 hours or more per week
- O Employed part-time, less than 35 hours per week
- O Employed in seasonal labor
- O Out of work for more than 1 year
- O Out of work for less than 1 year
- O Homemaker
- O Retired
- O Student
- O Unable to work
- O Don't know
- O Refuse

6 What is your household's total monthly income before taxes from all sources?

_____

- O Don't know

7 What is the highest degree or level of school you completed?

- O No school or kindergarten
- O 1st grade
- O 2nd grade
- O 3rd grade
- O 4th grade
- O 5th grade
- O 6th grade
- O 7th grade
- O 8th grade
- O 9th grade
- O 10th grade
- O 11th grade
- O 12th grade/GED
- O Trade/ vocational school certificate
- O Some college
- O College graduate
- O Don't know
- O Refuse

8 In what country were you born? [IF U.S. IS SELECTED SKIP TO QUESTION 10]

- O United States
- O Mexico
- O Another country, specify: _____
- O Don't know
- O Refuse

9 If you were not born in the US, how many years have you lived here [SKIP TO QUESTION 11]?

_____ YEARS

10. Were the following family members born in the U.S.? Circle “yes” or “No” to indicate for each family member.

	Yes	No
Mom		
Dad		
Mom’s mother		
Mom’s father		
Dad’s mother		
Dad’s father		

[Key for future use. Interviewer: Skip to question 12.]

- O 1st generation= Participant was not born in the US.
- O 2nd generation= Participant was born in US, but either of your parents were not.
- O 3rd generation= Participant was born in the US, all of his/her grandparents were born in another country.
- O 4th generation= Participant was born in the US, your parents were born in the US, at least one of his/her grandparents were born in another country.
- O 5th generation= Participant, participants parents and grandparents were all born in the US.
- O Refuse

12 Which of the following categories would you use to describe yourself? (Choose all that apply)

- O White
- O Black or African-American
- O Asian
- O Native Hawaiian or Other Pacific Islander
- O American Indian or Alaskan Native
- O Other, specify: _____
- O Don't know
- O Refuse

13. Which of the following categories would you use to describe yourself?

- O Hispanic or Latino
- O Other
- O Don't know
- O Refuse

13. Does your household receive any of the following forms of public assistance?

	Yes	No	Don't Know
SNAP/EBT/Food Stamps	O	O	O
WIC	O	O	O
TANF	O	O	O

Does your family receive any other type of public assistance? If yes, please specify

_____

_____

_____

_____

Now I will ask you some questions about your family's medical history.

14 What kind of health insurance or health care coverage do you have?

O No health insurance, self-pay. For example, you pay out of your own pocket

O No health insurance, sliding scale. For example, Income based discount clinics

O Private health insurance plan/Employer sponsored, like HMO or PPO

O AHCCCS

O Other state-sponsored health plan such as CMDP

O Other, specify: _____

O Don't know

15 Have you been told by a doctor that you have diabetes?

O Yes

O No

16 Have you ever been told by a doctor that you have/had gestational diabetes?

O Yes

O No

17 Have you ever been told by a doctor that you have high blood pressure?

O Yes

O No

18 Have you ever been told by a doctor that you have high cholesterol?

O Yes

O No

19 Have you ever been told by a doctor that you need to lose some weight?

O Yes

O No

	Very underweight	Underweight	Normal	Overweight	Very overweight
How would you describe your weight?	O	O	O	O	O

	Yes	No
Have you attempted to lose weight in the past year?	o	o

Now I will ask you some question about your personal food shopping habits. These questions are about you, and not your child.

25 About how much money do you (or the main food shopper) spend on food every month?

o $ _____

o Don't know

o Refuse

How important are the following when making food selections	Not important	Somewhat unimportant	Neutral	Somewhat important	Important
Cost	o	o	o	o	o
Taste	o	o	o	o	o
Convenience	o	o	o	o	o
Nutritional quality	o	o	o	o	o
Cultural traditions	o	o	o	o	o

How often do you do the following?	Never	Rarely	Sometimes	Mostly	Always
Prepare a list when you go grocery shopping?	O	O	O	O	O
Read the ingredients section to help you to decide what foods to buy?	O	O	O	O	O
Use the nutrition label to help you make food selections?	O	O	O	O	O

29 If you look at the nutrition panel to make food selections, what do you look for? (Interviewer: IF answer to previous question was never, choose the last answer choice) (Interviewer: DO NOT READ ANSWER CHOICES. Check all that participant mentions)

- O Calories
- O Total Fat
- O Saturated Fat
- O Cholesterol
- O Carbohydrates
- O Sugars
- O Fiber
- O Protein
- O Sodium
- O Vitamins
- O Minerals
- O I don't use the nutrition panel when selection foods

How often do you do the following?	Never	Rarely	Sometimes	Mostly	Always
Eat meals that were prepared in your home?	O	O	O	O	O
Eat dinner sitting at the table with your family?	O	O	O	O	O
Make meals from scratch?	O	O	O	O	O

35 On a typical week, how often do you do any of the following activities…?

	Times per week	Never[0]
Eat breakfast		O
Eat fried foods		O
Eat fast food		O
Eat at restaurant (not fast food)		O

The next question will be about moderate to vigorous physical activity. Moderate to vigorous physical activity is any activity that increases your heart rate and makes you get out of breath some of the time.
--Physical Activity can be done in sports, playing with friends, or walking to school
--Some examples of physical activities are running, brisk walking, rollerblading, biking, dancing, swimming, soccer, basketball, jumping rope, doing heavy house or yard work, cleaning the car, etc.

17 Physical Activity

	0	1	2	3	4	5	6	7
During the past week, how many days did you get moderate to vigorous physical activity for a total of at least 30 minutes?	O	O	O	O	O	O	O	O
In a typical week, how often do you visit the nearest public recreation center?	O	O	O	O	O	O	O	O

Over the past week, how many times did you…	# of times
Go for a walk/hike that lasted longer than 10 minutes	
Go jogging	
Go swimming	
Zumba/aerobics	
Play a sport	
Go dancing	
Lift weights	
Other activities…	
a)	
b)	
c)	
d)	

42 On a typical weekday, how much time do you usually spend…

	Hours	Minutes	Never[0]
Watching television/videos/DVDs			O
Using the computer or another electronic device (even if at work)			O
Sleeping			O
Driving			O

43 On a typical weekend day, how much time do you usually spend…

	Hours	Minutes	Never[0]
Watching television/videos/DVDs			O
Using the computer or another electronic device (even if at work)			O
Sleeping			O
Driving			O

Below we have listed some things which participants report can make it difficult to change their eating habits. For each item, please indicate the extent to which this factor has made it difficult for you to
follow appropriate eating habits in THE PAST 3 MONTHS.

	Not at all a problem for me				A very important problem for me
	1	2	3	4	5
Appropriate foods are not available in my home.	O	O	O	O	O
My family does not support my efforts to change my diet.	O	O	O	O	O
I have trouble estimating portion sizes	O	O	O	O	O
It is difficult to motivate myself to eat appropriately.	O	O	O	O	O
I use food as a reward or treat for myself.	O	O	O	O	O
It is difficult to find time to plan appropriate meals for my family.	O	O	O	O	O
I don't see any benefits from my efforts to improving my diet	O	O	O	O	O

It is difficult to shop for one person in the grocery store.	O	O	O	O	O
I don't know what foods I should eat to improve my diet	O	O	O	O	O
I have difficulty controlling my eating when I am with friends.	O	O	O	O	O
When I am hungry I have trouble controlling what I eat.	O	O	O	O	O
Eating well is rewarding but I have trouble staying motivated to keep preparing healthy meals.	O	O	O	O	O
Changing my diet to reduce sugar seems too complicated.	O	O	O	O	O
Changing my diet to increase fruits and vegetables seems too complicated.	O	O	O	O	O
I feel deprived when I have to restrict so many foods.	O	O	O	O	O
I find it difficult to select appropriate foods when shopping.	O	O	O	O	O
I never feel that my appetite is satisfied when I am trying to eat more healthfully.	O	O	O	O	O

The foods that are more healthful for me cost more than I can afford.	O	O	O	O	O
The taste of healthful foods is different.	O	O	O	O	O
Resisting tempting unhealthful foods in my work setting is difficult.	O	O	O	O	O
When I am busy or feeling overwhelmed, I find it difficult to remember all of the rule about what foods are appropriate.	O	O	O	O	O
When I am with my family I find it difficult to watch what I eat.	O	O	O	O	O
My friends do not support me when I try to change my eating.	O	O	O	O	O

Place for walking/cycling	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
	1	2	3	4
There are idewalks on most of the streets in my neighborhood.	O	O	O	O
Sidewalks are separated from the road/traffic in my neighborhood by parked car.	O	O	O	O
There is a grass/dirt strip that separates the streets from the sidewalks in my neighborhood.	O	O	O	O
My neighborhood streets are well lit at night.	O	O	O	O
Walks and bikers in the streets can be easily seen by people in their homes.	O	O	O	O
There are crosswalks and pedestrian signals to help walkers cross busy streets in my neighborhood.	O	O	O	O

Neighborhood surroundings/aesthetics	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
	1	2	3	4
There are trees along the streets in my neighborhood.	O	O	O	O
There are many interesting things to look at while walking in my neighborhood.	O	O	O	O
There are many attractive natural sight in my neighborhood (such as landscaping views).	O	O	O	O
There are attractive buildings/homes in my neighborhood.	O	O	O	O

Traffic hazards	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
	1	2	3	4
There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk in my neighborhood.	O	O	O	O
The speed of the traffic on most nearby streets is usually slow (30 mph or less).	O	O	O	O
Most drivers exceed the posted speed limits while driving in my neighborhood.	O	O	O	O

Crime	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
	1	2	3	4
There is a high crime rate in my neighborhood.	O	O	O	O
The crime rate in my neighborhood makes it unsafe to go on walks during the day.	O	O	O	O
The crime rate in my neighborhood makes it unsafe to go on walks during the night.	O	O	O	O

Now we will ask you some questions about the foods that you eat. When answering these questions think about your typical diet over the past month.

During the past month, how many times did you eat or drink…	# times	Never[0]	Daily[1]	Weekly[2]	Monthly[3]
Fruit	_____	O	O	O	O
Vegetables (excluding fried potatoes)	_____	O	O	O	O
Regular soda pop that contains sugar		O	O	O	O
Energy drinks such as Gatorade, Red Bull, and Vitamin Water (do not include sugar free)	_____	O	O	O	O
Sweetened fruit juices such as Kool-aid, tampico, suny delight, capri-sun and aguas frescas? Include fruit drinks you made at home and added sugar to. Do not include 100% fruit juice and drinks with things like Splenda or Equal.	_____	O	O	O	O
Coffee or tea with sugar or honey added? Do not include drinks with things like Splenda or Equal. Include pre-sweetened tea and coffee drinks such as Arizona Iced Tea and Frappucino.	_____	O	O	O	O
Cookies, cake, pie, or brownies? Do not include sugar-free kinds.	_____	O	O	O	O
Ice cream of other frozen desserts? Do not include sugar-free kinds.	_____	O	O	O	O

The remaining questions are about “your child.”. Please remember to think about your child who will also be enrolled in this program with you when answering these questions.

1 Are you the...?

O Biological parent

O Legal guardian/caregiver

2 Is your child...?

O Female

O Male

3 What is your child's date of birth? (MM/DD/YYYY)

_____/_____/20___

5 In what country was your child born?

O United States

O Mexico

O Another country, specify: _____

O Don't know

O Refuse

7 Which of the following categories would you use to describe your child? (Choose all that apply)

O White

O Black or African-American Asian

O Native Hawaiian or Other Pacific Islander

O American Indian or Alaskan Native

O Other, specify: _____

O Don't know

O Refuse

8. Which of the following categories would you use to describe your child? (Choose all that apply)

O Hispanic or Latino

O Other

O Don’t know

O Refuse

11 Has your child's other parent ever been told by a doctor that he/she has diabetes?

O Yes

O No

O Don't know

16 Has you child's other parent ever been told by a doctor that they had gestational diabetes? [If the participating parent is a female answer N/A]

O Yes

O No

O N/A

O Don't know

17 Has you child's other parent ever been told by a doctor that they have high blood pressure?

O Yes

O No

O Don't know

18 Has you child's other parent ever been told by a doctor that they have high cholesterol?

O Yes

O No

O Don't know

19 Has you child's other parent ever been told by a doctor that they need to lose some weight?

O Yes

O No

O Don't know

12 What kind of health insurance or health care coverage does your child have?

- O No health insurance, self-pay. For example, you pay out of your own pocket
- O No health insurance, sliding scale. For example, Income based discount clinics
- O Private health insurance plan/Employer sponsored, like HMO or PPO
- O AHCCCS
- O Other state-sponsored health plan such as CMDP
- O Other, specify: _____
- O Don't know.

15 What is your child's usual amount of sleep each weekday, combining nighttime sleep and naps? _____

15 What is your child's usual amount of sleep each weekend day, combining nighttime sleep and naps? _____

Are the following items available in your child's bedroom?

		Yes	No
a.	Television	O	O
b.	Desktop computer	O	O
c.	Video game system	O	O

The next question will be about moderate to vigorous physical activity. Moderate to vigorous physical activity is any activity that increases your child's heart rate and makes your child get out of breath some of the time.
--Physical Activity can be done in sports, playing with friends, or walking to school
--Some examples of physical activities are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, surfing, jumping rope, playing 4-square and playing hopscotch

17 Physical Activity

	0	1	2	3	4	5	6	7
During the past week, how many days did your child get moderate to vigorous physical activity for a total of at least 60 minutes per day? Consider all the time your child spends in physical activity each day (but do not include school physical education class).	O	O	O	O	O	O	O	O
In a typical week, how often is your child physically active in the nearest public recreation center?	O	O	O	O	O	O	O	O

24 Over the past month, how many times did you take your child to…?

	# of times
A park	
A sporting event that they participated in	
Swimming	
Hiking	
To a gym	

18 On a typical week day, how much time does your child spend…

	Hours	Minutes	Never
Watching television/videos/DVDs			O
Playing video games like Xbox or PlayStation?			O
Using a computer or other electronic device.			O
Riding in a car			O

18 On a typical weekend day, how much time does your child spend…

	Hours	Minutes	Never
Watching television/videos/DVDs			O
Playing video games like Xbox or PlayStation?			O
Using their computer or smart phone to browse the internet?			O
Riding in a car			O

[Noe, all these are from your previous surveys. We need your recommendations regarding whether to leave or remove. I don't think we need these questions, but based on your earlier recommendation to add items from your previous studies, I would like to confirm your opinion here.]

Begin answering here. Mark ONLY ONE box per food.

Fruits & Vegetables	**Never**	**Month**	**Each Week**			**Each Day**				
		1-3 times	1-2 times	3-4 times	5-6 times	1 time	2 times	3 times	4 times	5 or more
1. 100% orange or grapefruit juice?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2. Other 100% fruit juices?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
3. Green salad?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

4. French fries or fried potatoes?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
5. Baked, boiled, or mashed potatoes?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
6. Vegetables (not potatoes & salad)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
7.Fruit (not juices)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
8. Fruit in smoothies?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

Dairy Foods	**Never**	**Month**	**Each Week**			**Each Day**				
		1-3 times	1-2 times	3-4 times	5-6 times	1 time	2 times	3 times	4 times	5 or more
9. Regular cheese (American, Monterey jack)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
10. Low-fat cheese (Mexican queso or mozzarella)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
11. Whole milk?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
12. Low-fat milk (2%)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
13. Skim milk (non-fat or 1%)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
14. Regular yogurt	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

15. Low-fat yogurt	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

Meats/Fish/Eggs/Beans	**Never**	**Month**	**Each Week**			**Each Day**				
		1-3 times	1-2 times	3-4 times	5-6 times	1 time	2 times	3 times	4 times	5 or more
16. Bacon, hot dogs, sausage, chorizo,bologna?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
17.Cold cuts/lunch meat?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
18. Low-fat cold cuts/lunch meat?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
19. Beef, pork or ham?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
20. Chicken or turkey?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
21. Eggs?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
22. Fish?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
23. Peanut butter?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

Meats/Fish/Eggs/Beans	**Never**	**Month**	**Each Week**			**Each Day**				
		1-3 times	1-2 times	3-4 times	5-6 times	1 time	2 times	3 times	4 times	5 or more
24. Nuts, all types, sunflower seeds?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
25. Refried beans?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
26. De la olla, baked, kidney, pintos, lentils?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

	Never	**Month**	**Each Week**	**Each Day**

Other Drinks (NOT Milk & 100% Fruit Juice)		1-3 times	1-2 times	3-4 times	5-6 times	1 time	2 times	3 times	4 times	5 or more
27. Water?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
28. Regular Soda (Coke, Sprite, Orange Soda)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
29. Diet Soda?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
30. Flavored drinks (Kool-aid, Tampico, Hi-C)?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
31. Aguas frescas with fruit?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

Fats & Sweets	**Never**	**Month** 1-3 times	**Each Week** 1-2 times	3-4 times	5-6 times	**Each Day** 1 time	2 times	3 times	4 times	5 or more
32. Butter or Mayonnaise?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
33. Salad dressing?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
34. Low-fat salad dressing?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
35. Potato chips, Corn chips, Tortilla chips, Cheetos?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

	Never	**Month**	**Each Week**	**Each Day**

Fats & Sweets		1-3 times	1-2 times	3-4 times	5-6 times	1 time	2 times	3 times	4 times	5 or more
36. Sweet pastries? (cookies, cakes, donuts, pan dulce)	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
37. Sugar candies?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
38. Chocolates?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
39. Ice Cream?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
40. Popsicles?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

Grains	**Never**	**Month**	**Each Week**			**Each Day**				
		1-3 times	1-2 times	3-4 times	5-6 times	1 time	2 times	3 times	4 times	5 or more
41. Cereal without sugar? (oatmeal, Kix, Cheerios)	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
42. Sugar cereals? (Lucky Charms, Captain Crunch, Frosted Flakes)	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
43. White rice or regular pasta?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
44. Brown rice or whole wheat pasta?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
45. Corn tortillas?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
46. Flour tortillas?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
47. White bread?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
48. Wheat bread?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

49. Crackers?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

APPENDIX F

3-DAY FOOD RECORD FORM

Athletes for Life Program Participant ID:_____

Food Record Form

A food record form is used to record the amounts and types of foods you eat and drink each day. Please record your food intake for **three random days** (e.g. Tuesday, Thursday, Sunday, etc.), including one weekend day. In recording the foods/beverages you consume each day, try to be as precise as possible with the amounts and descriptions of each food/beverage consumed.

Attached you will find a blank food record form. Below are instructions for completing the form.

- **Record everything, forget nothing.** Do not forget to write down everything that you eat and drink, including foods consumed for both meals and snacks.
- **Include condiments and oils used for cooking.**
- **Be accurate with food descriptions.** Write down clear descriptions of the food or beverage that you consume. In addition, it is important to mention how the food was prepared. For example: baked chicken, toasted wheat bread, boiled carrots.
- **Record the amount of food/beverage consumed.** You can use household measures such as cups, tablespoons, teaspoons, etc., or weight and volume measures such as ounces, pounds, grams, etc.
- **Record everything immediately after eating.** Carry the food record with you everywhere so that you don't forget to write down anything you've eaten.
- **Ask the assistance of the person who prepared the food.** The person who prepares your meals or snacks, if it is not yourself, may have better idea of what was in the food you ate than you do.
- **Include all supplements.** Include vitamins, minerals, Tums, Fibercon, etc.
- Use more than one form per day if needed.

Example of a Food Record:

Day of the week: Monday

Place and Time	Amount	Portion Size	Description of Foods and Beverages	Brand
Home 9:00 am	2	Large	Eggs, scrambled	N/A
Home 9:00 am	1	teaspoon	Canola oil	Crisco
Home 9:00 am	1	cup	whole milk	Hood
Home 9:00 am	1	Large	wheat bagel	Lenders
Home 9:00 am	2	slices	baked ham	Boar's Head
Home 9:00 am	1	ounce	Cheddar cheese	Stella

Day of the week _____Monday_____ Date _____

Place and Time	Amount	Portion Size	Description of Foods and Beverages	Brand

Day of the week _____Thursday _____ Date _____

Place and Time	Amount	Portion Size	Description of Foods and Beverages	Brand

Day of the week _____Saturday ____ Date _____

Place and Time	Amount	Portion Size	Description of Foods and Beverages	Brand